STS CONSULTANTS, LTD.

# Amended Removal Action Work Plan

## FOR REVIEW

341 East Ohio Street Site
Chicago, Illinois

STS Project No. 1-25585-XG
March 13, 2002

Attachment 1 Amended Work Plan

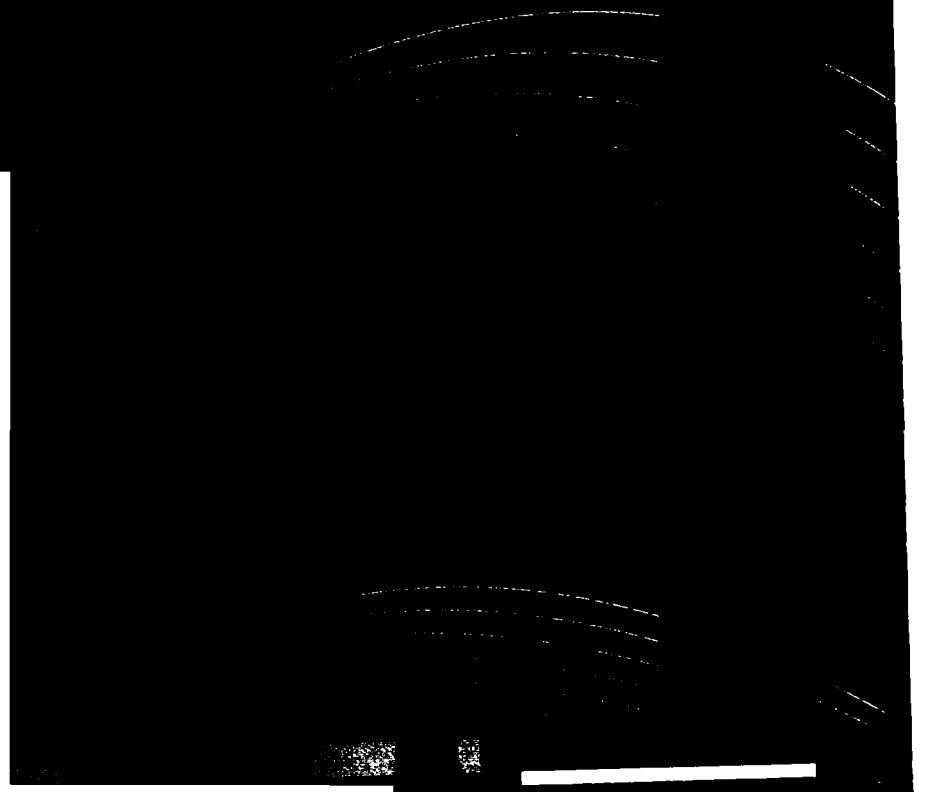
Attachment 2 Revised Organizational Chart (Figure 2-1)

Attachment 3 Revised Construction Schedule (Figure 3-2)

Attachment 4 Health and Safety Plan, Revision 2

Attachment 5 SOP-500 Immunoassay Pesticide Field Test Method
- Sample Extraction Kit User's Guide
- EnviroGard™ Chlordane in Soil Test Kit

# THE INFRASTRUCTURE IMPERATIVE



**Attachment 1**

Amended Work Plan

## STS CONSULTANTS, LTD.

**Amended Removal Action Work Plan**
**341 East Ohio Street**
**Chicago, Illinois**

Teachers' Retirement System of the
State of Illinois

STS Project No. 1-25585-XG
March 13, 2002

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Teachers' Retirement System of the State of Illinois
STS Project No. 1-25585-XG
March 13, 2002

**TEACHERS' RETIREMENT - GMO SITE**
**AMENDED REMOVAL ACTION WORK PLAN**
**MARCH 13, 2002**

## 1.0 SCOPE AND OBJECTIVES

The subject site for this Removal Action Work Plan (the "site" or the "subject site") at 341 East Ohio Street, Chicago, Illinois, is a vacant parcel of approximately 2.16 acres located at the northwest corner of McClurg Court and East Grand Avenue, Chicago, Illinois and is depicted on Figure 1-1. The site is currently a vacant, at-grade paved parking lot; however, the site is not presently being used for parking. Teachers' Retirement System of the State of Illinois ("TRS") previously made a mortgage loan secured by the site. After such mortgage went into default, TRS acquired the site by deeds in lieu of foreclosure.

The site has historically been used for several different purposes, including buildings used to support supply and wholesale distributors; shipping and receiving operations; an experimental lab, a machine shop, printing and lithography operations and a waxed paper manufacturer. Velsicol Chemical Corporation (Velsicol) used all of the site buildings constructed by the previous occupants as their corporate headquarters and as research and development laboratories for herbicides, insecticides and plant growth regulators from as early as 1917. Foundations and basements from these buildings are expected to be found on the property during the excavation and removal action process.

The site is across the street (north of East Grand Avenue) from the site at 316 East Illinois, Chicago, Illinois which is owned by River East, LLC, and on which radiologically impacted soils were previously detected by the U. S. Environmental Protection Agency ("USEPA"). USEPA determined that the radiologically impacted soil at the 316 East Illinois Street site was associated with the former operations of Lindsay Light Company at 316 East Illinois Street and 161 East Grand Avenue. On June 6, 1996, USEPA issued a unilateral administrative order ("UAO") pursuant to Section 106 of the Comprehensive Environmental Response, Compensation and Liability Act ("CERCLA") to the Chicago Dock and Canal Trust (now known as River East LLC) and to Kerr-McGee Chemical Company (the corporate successor of Lindsay Light Company and now known as Kerr-McGee Chemical, LLC) requiring River East and Kerr-McGee to perform a removal action with respect to the radiologically impacted soil on the 316 East Illinois Street site (which USEPA designated "Lindsay Light II") and on any areas off the Lindsay Light II site on which such radiologically impacted soils were found. Subsequently, radiological impacts were discovered

at the site which was owned by Grand Pier Center, LLC immediately to the west of (and across Columbus Drive from) Lindsay Light II and which was designated by USEPA as "Lindsay Light II/RV3 North Columbus Drive". USEPA determined that the radiological impacts at Lindsay Light II/RV3 North Columbus Drive were associated with the former operations of Lindsay Light Company.

On March 29, 2000, USEPA amended the UAO to require Kerr-McGee, River East and Grand Pier to perform removal action at Lindsay LightII/RV3 North Columbus Drive.

TRS has previously entered into a contract to sell the subject site to a third party purchaser which engaged environmental consultants to perform environmental investigations of the site. B. Koh & Associates, Inc. ("Koh") performed a radiological investigation of the site including surface gamma radiation readings, down-hole radiation readings and soil sampling and analysis. Koh's report dated May 2000 documented its findings of elevated gamma radiation and radiological concentrations at the site. TRS reported the findings in the Koh report to USEPA. On March 1, 2001, USEPA issued an Action Memorandum Amendment setting forth determinations by USEPA that, among other things, (1) the radiological impacts at the site are associated with the former operations of Lindsay Light Company and (2) the UAO requires Kerr-McGee to proceed with a removal action with respect to the radiological impacts at the site. TRS has made demand on Kerr-McGee to perform all removal actions required at the site, but Kerr-McGee has not agreed to perform all such removal actions. In order to provide for the performance of the removal actions, TRS and Kerr-McGee have agreed that (A) TRS will perform excavation, screening and sampling at the site as described in this Work Plan, (B) Kerr-McGee will transport and dispose of the radiologically impacted soils removed from the site, and (C) each of TRS and Kerr-McGee reserve their rights to, among other things, recover their costs with respect to their respective work activities which they will perform with respect to the site.

TRS has also determined that a portion of the site in the vicinity of the building formerly located on the site at 330 East Grand Avenue has been impacted by pesticides. TRS has obtained a report from STS entitled Pesticide Investigation dated February 12, 2002 (the Pesticide Investigation Report) which sets forth the results of the investigation for pesticides in such portion of the site (referred to as the "Pesticide Impact Area"). A copy of the Pesticide Investigation Report is attached to this Work Plan as Attachment 4.

This Work Plan:

(a) describes the survey methods which are proposed for identifying the radiologically impacted materials

(b) proposes excavation procedures for eliminating the radiologically-impacted soils from the site

(c) proposes excavation and sampling procedures for removing certain pesticide-impacted soils from the Pesticide Impact Area.

(d) details the radiological screening methodology

(e) describes the air monitoring and health and safety plan

(f) outlines closure documentation and material disposal.

It is the intent of this Work Plan that the work activities described will be consistent with the National Contingency Plan at 40 CFR Part 300 and that such work activities constitute a time critical removal action under 40 CFR Section 300.415. TRS requests that USEPA confirm that the work provided in this Work Plan constitutes a time-critical removal action consistent with the NCP.

It is the intention of this Work Plan, upon approval by USEPA, to perform the site survey, identify radiologically impacted soil and materials, remove all radiologically impacted soil and materials above the proposed cleanup threshold of 7.1 pCi/g total radium (Ra-226 + Ra-228), and remove all soils and fill material with pesticide concentrations in excess of the TACO Tier 1 residential standards for inhalation and ingestion as set forth in 35 Ill. Admin. Code Part 742, Appendix B, Table A from the Pesticide Impact Area. Upon completion of all required excavation and removal of all identified radiologically impacted materials above the proposed cleanup threshold of 7.1 pCi/g total radium (Ra-226 + Ra-228) and of all pesticide-impacted materials above the TACO Tier 1 residential standards for inhalation and ingestion, TRS will request a closure document from USEPA to the effect that (i) all such work has been completed in accordance with this Work Plan, (ii) no further radiological investigation or removal action is required at this site, (iii) there is no evidence of any radiologically impacted material remaining at the site, and (iv) construction and development work on the site may proceed without further regulatory requirements relating to radiological impacts.

## 2.0 MANAGEMENT STRATEGY AND KEY PERSONNEL

This section of the work plan describes the management structure that TRS and its consultants will use to accomplish the excavation and removal activities.

### 2.1 Project Overview

There are three phases of work which comprise this Work Plan. These consist of the Investigation and Delineation Phase, the Initial Contaminant Removal Phase, and the Site-wide Excavation, Monitoring and Removal Phase. The Investigation and Delineation Phase was begun with the survey and sampling work previously completed by Koh and Associates, as reported in their May 2000 report. This phase will continue with the site surveys to be conducted as the asphalt pavement is removed. The Initial Contaminant Removal Phase will consist of the removal of the radiologically impacted zones identified in Phase 1, as well as the removal of pesticide-impacted soils in the pesticide impact area. Finally, the Site-wide Excavation, Monitoring and Removal Phase will involve the surveying of all fill soils on site, and the segregation and removal for disposal of all radiologically impacted soils encountered in excess of the radiological cleanup standard of 7.1 pCi/g total radium. A more complete description of these activities is presented in Section 3.0, Methodology.

### 2.2 Project Execution

Project execution consists of the three phases described above in Section 2.1, Project Overview. The following activities will be required by TRS to enable the project to begin.

- Finalize a contract with Kerr-McGee regarding its role to transport and dispose of the excavated materials, or obtain necessary authorizations to move excavated materials to EnviroCare of Utah, Inc. for permanent disposal.

- Enter into a contract with a qualified contractor for the excavation services. Arrange appropriate logistical support services such as fencing and site security, office and equipment trailers.

- Notify and obtain appropriate permits for the implementation. This includes City of Chicago, USEPA and State of Utah authorities.

The following activities must be accomplished to complete the project:

- All identified radiologically impacted material above the proposed cleanup threshold of 7.1 pCi/g total radium (Ra-226 + Ra-228) has been removed from the site.

- All identified pesticide-impacted soils above the cleanup threshold of Illinois EPA Site Remediation Program TACO Tier 1 residential standards for ingestion and inhalation have been removed from the Pesticide Impact Area.

- TRS has received USEPA verification sign-off that all radiologically impacted materials above such cleanup threshold have been removed from the site.

- Equipment and personnel have been demobilized from the site.

- TRS has submitted the required documentation to USEPA for closure of the site.

- USEPA has responded acknowledging the sufficiency of the removal and documentation, in accordance with the UAO and Amendments.

### 2.3 Project Management Structure

The management structure under which the project will be accomplished is illustrated in Figure 2-1 of this Work Plan. The Project Team consists of USEPA and its support organizations, TRS and its consultants, the construction teams comprised of TRS' consultants, contractors and subcontractors, and Kerr-McGee and its contractors involved in the transportation and disposal tasks. The TRS Project Team consists of the following members:

- TRS Project Manager, Mr. Tom Pabian
- STS Project Coordinator, Mr. Richard Berggreen
- Quality Assurance Manager, Mr. Ron Palmieri
- STS Project Manager, Mr. John Esser
- STS Field Team Leader, Mr. Dumas Guerrier
- Health and Safety Officer, Mr. Keith Carlson
- Kerr-McGee, Mr. Mark Krippel
- Health Physicist Supervisor, Mr. Glen Huber

The duties and responsibilities of these positions and organizations are summarized below.

USEPA will be represented by its On-Scene Coordinators (OSCs), whom we understand will be Mr. Fred Micke and Ms. Verneta Simon. Mr. Larry Jensen, Radiation Health Physicist and other support staff will assist the OSCs. Argonne National Laboratory will provide laboratory subcontract services for radiological analysis of samples from this project.

TRS will be represented by its project manager who will be responsible for communications between TRS and the project team. The TRS project manager will review project documents, plans, and progress reports to confirm the plans and implementation are consistent with TRS objectives.

The Project Team Project Coordinator will have overall responsibility for coordination of project communications and resources. These responsibilities include communications between the project team and USEPA, and among the various members of the project team, including Kerr-McGee, the Health Physics subcontractor, the excavation contractors, and other subcontractors on the project. The position description is included in the QAPP.

The STS Project Manager will be responsible for day-to-day implementation of this Work Plan. This will include coordination of schedules with the contractors and subcontractors, planning and scheduling activities with the USEPA to provide for verification of remediated locations, and documentation of activities as provided for in this Work Plan.

The Field Team Leader is responsible for coordinating the field activities, in particular coordinating the excavation and health physics technician subcontractors. The Field Team Leader will be responsible for day-to-day communications with the USEPA's OSCs whenever the OSCs are on site.

The Project Quality Assurance Manager will provide guidance on quality assurance/quality control (QA/QC) issues. This includes but is not limited to guidance regarding sampling, data validation and chain of custody procedures. The Quality Assurance Manager will provide the Project Coordinator copies of reports pertaining to QA/QC.

The Quality Assurance Manager functions independently from the personnel directly responsible for accomplishing the excavation and removal. He/she reports to the Project Coordinator and the TRS Project Manager and has access to higher levels of management with whom he/she can consult to resolve quality related project issues.

Kerr-McGee will be responsible for transportation and disposal of the radiologically impacted materials excavated and removed from the site. That responsibility includes health physics personnel to survey the transport containers, subcontractor transportation and logistics personnel, and documentation for shipping and disposal. The disposal is proposed to be under an existing contract with EnviroCare of Utah, Inc. In the event Kerr-McGee is unable to fulfill this role, a logistics subcontractor will be available to complete this work. The anticipated scope of this work is presented in Appendix 1 of this Work Plan.

### 2.4 Delineation and Design

Delineation of the radiologically impacted materials was initiated through an investigation completed by B. Koh and Associates, Inc. as documented in its report dated May 2000, "Summary of Radiological Survey, Time-Life Property, Chicago, Illinois". The delineation will be further developed in the initial stages of removal as the pavement is removed from the site and the ground is surveyed. This is described below in Section 3.1.3, Site Survey and Section 3.1.5, Excavation Work.

The removal work scope will require sloping of the excavation side slopes up to the property line. The wedge of material remaining unexcavated on-site will be sloped as steeply as can be safely accomplished without endangering the adjacent right-of-way, likely on the order of 1 V:1.5 H. Prior to excavation, this wedge of material was surveyed for elevated gamma radiation utilizing a series of borings on a 2-meter square grid as described in the letter report dated February 6, 2002 prepared by STS entitled "Perimeter Drilling Results", 341 East Ohio Street, Chicago, Illinois – STS Project No. 1-25585-XG, Correspondence No. 041" (the "Perimeter Drilling Report") which was submitted to USEPA on February 8, 2002. Any radiologically impacted material in excess of the radiological cleanup standard of 7.1 pCi/g total radium as identified in the Perimeter Drilling Report will be removed to the property line during the excavation phase of the project. In addition, following completion of the excavation, the surface of the sloping wedge of material remaining in place will also be surveyed.

The slope design will be submitted for review and will conform to the requirements of the appropriate public agency or governmental oversight unit.

The delineation of the pesticide-impacted soils to be removed was initiated in the GaiaTech Phase II Soil and Groundwater Investigation, May 11, 2000 ("GaiaTech"). The delineation was further developed through the Pesticide Investigation Report attached as Attachment 4 to this Work Plan. The delineation

will be further refined in the initial stages of the excavation following the removal of the known radiologically-impacted soils in the Pesticide Impact Area.

### 2.5 Construction

Excavation and removal activities will be completed in accordance with the terms of the UAO, the specifications of the Construction Quality Assurance Plan (CQA Plan) and this Work Plan. The CQA Plan is Attachment 1 to this Work Plan.

Excavation will be scheduled so that activities will proceed expeditiously. Activities will normally be scheduled during daylight hours, Monday through Friday. Exceptions to this may be made where, for example, the Field Team Leader determines that extended work hours will allow a work item to be completed or secured before a weekend or before inclement weather. It is proposed to the extent possible to transport containers at night to avoid traffic congestion. The USEPA will be advised as soon as practical before working during extended hours.

### 2.6 Maintenance

Following completion of the removal, it is proposed to continue the site security, i.e., fencing the entire perimeter and maintain the site as at the completion of the removal and replacement of the clean excavated spoil. Environmental Remediation Caution signs will be removed from the site perimeter upon receipt of notice from USEPA that all radiologically impacted material has been removed from the site. Any additional work beyond the completion of the removal and replacement of the clean spoil will be in accordance with the construction permit specifications from the City of Chicago.

### 2.7 Monitoring

Air monitoring will be conducted at two levels. Site perimeter monitoring will be conducted at the four sides of the site (north, south, east, and west). This air monitoring is for the purpose of documenting, and if detected, initiating measures to control off-site airborne contamination. Air monitoring will be conducted in accordance with the Air Monitoring Procedure, SOP 212.

Personal air monitoring will be required for workers in an exclusion zone. Procedures for personal air monitoring are presented in the Health and Safety Plan included in Attachment 3.

### 2.8 Reporting

Monthly progress reports will be submitted to USEPA beginning 30 days after USEPA's approval of this Work Plan, and will be submitted monthly by the 15th of each month until termination of the UAO as applicable to this site, unless otherwise directed by the OSC. These monthly reports will describe all significant developments during the preceding period, including the work performed, and any problems encountered, analytical data received during the reporting period, and developments anticipated during the next reporting period, including a schedule of work to be performed, anticipated problems, and planned resolutions.

A closure report will be prepared upon completion of the removal of all identified impacted material from the site, and acknowledgement from USEPA that the removal work is complete and the closure report is due. The closure documentation report will provide a summary of the locations remediated, the volumes of all materials removed and their disposal locations, resources allocated and costs for the removal, analytical results, field data documenting the clean closure, and a certification in accordance with the requirements of the UAO. This closure documentation report will be provided within 60 days of the completion of the removal of all identified radiologically-impacted soil.

### 2.9 Existing Data

The following reports of previous environmental investigations were provided by TRS for the preparation of this Work Plan.

- Letter dated August 22, 1990 from OHM Corporation to GMO Limited Partnership
- Environmental Site Assessment dated August 28, 1990 prepared by Professional Service Industries, Inc.
- Visual Site Inspection dated December 30, 1993 prepared by USEPA, Region V, with attached Preliminary Assessment/Visual Site Inspection Report dated December 16, 1993 prepared by PRC Environmental Management, Inc.
- Preliminary Environmental Review dated March 8, 2000, prepared by GaiaTech, Inc.

- A Phase II Soil and Groundwater Investigation Report Time-Life Property, Grand Avenue and McClurg Court, Chicago, Illinois, dated May 11, 2000, prepared by GaiaTech, Inc.

- Summary of Radiological Survey Time-Life Property, Chicago, Illinois, dated May 2000, prepared by B. Koh & Associates, Inc.

- Scanner Van Survey of the Chicago, Illinois Streeterville Area dated July 12, 2000 prepared by USEPA Radiation and Indoor Environments National Laboratory.

## 3.0 METHODOLOGY

### 3.1 Description of Work Activities

#### 3.1.1 Site Preparation

The site is currently a vacant, out of service, paved parking lot. There are no structures on the property. A traffic guardrail surrounds most of the site and will require removal. The existing light poles on the site will also require removal. Storm drains are present on-site and will require removal as work proceeds. They will likely be removed as part of excavation rather than in the utility abandonment task. Structures/foundations from Velsicol should be expected. Prior to beginning the removal of the pavement, no other demolition activities are anticipated as part of site preparation.

A 5 meter by 5 meter site grid will be established for the site. Grid lines will be alphabetic from north to south, and numeric from west to east. Site locations will be referenced to this alpha-numeric grid during the remediation and closure documentation.

Other site preparation efforts such as fencing, utility closure, logistical support facilities, and pavement removal in preparation for surveys and removal efforts are discussed below.

#### 3.1.2 Permits

All necessary permits and sign-offs will be secured for the implementation of the site excavation, survey, and remediation work. Permit applications will reflect the exemption available for work on CERCLA-directed project sites. Permits and sign-offs for work at this site may include but are not limited to the following:

- excavation permit;
- Board of Underground review;
- street closure/sidewalk closure permit;
- consultation with the Sewer Department;
- meetings with utilities; and
- consultation with the City of Chicago Department of Environment.

Details of the permit process, the necessary permits, permitting agencies, and utility protection are provided in the Permitting and Access Requirements Plan, Appendix 2.

### 3.1.3 Site Survey

Prior to any work at the site including demolition or removal of any pavement or features at the site, the following will be documented by the Field Team Leader, his designee, or a licensed surveyor.

- The site grid at 5 meter spacing will be established.
- The site boundaries will be located and marked.
- The location of all surface features such as the guard rail, storm drain catch basins, utility vaults, light standards, etc.
- A photographic record of the site will be made and retained in the project files.

The beginning of the removal work task will be to begin removal of the asphalt pavement cover in stages. Once the asphalt paving is removed from each area of the site, as shown in Figure 3-1, 100% of the soil surface in each such area will be surveyed for elevated gamma readings. This survey work will be part of the Investigation and Delineation Phase that was begun with the Koh investigation as documented in its report dated May 2000. The survey will cover the exposed soil on survey lines spaced 5 meters. Gamma count values shall be taken at intervals spaced 5 meters (5 x 5 meter grid). The site grid will be marked by stakes and flagging at the edges of the property and by paint on the ground surface on the interior of the site. The areas between the grid points will be scanned following Documents SOP 210 so as to cover the intra-grid areas.

### 3.1.4 Utilities

For this project, "utilities" include natural gas, water, sewer, communication, cable television lines, and electrical power distribution systems. Prior to the physical site survey, city and utility company records concerning location and construction of utilities on and in the general vicinity will be reviewed and consolidated on a single Utility Plan Drawing. This drawing will be based on City of Chicago maps. The appropriate utility companies or their designees will be asked to verify the location by originating a

request through the Chicago Utility Alert Network (DIGGER) phone number: 312-744-7000, and through application to the Chicago Board of Underground.

During the physical site survey, the locations of the identified utilities will be "ground-truthed" by observing the locations of power and phone poles, above-ground transformers (where electrical distribution lines are below ground), manholes, water meters, natural gas meters, phone boxes, surface indications such as utility vaults, catch basins, and surface depressions which can occur over utility trenches, and the locations marked by the utility companies or their representatives.

The locations of these utility indicators will be plotted on the Utility Plan Drawing, and compared with indicated locations. Discrepancies of more than 1 meter (about 3 feet) will be noted. Procedures for working in the vicinity of utilities and repair to damaged utilities will be discussed with the excavation contractor crews. All work on and in the vicinity of utilities will be in accordance with City and utility company specifications.

### 3.1.5 Excavation Work

Excavation will proceed in two phases, the initial contaminant removal phase and the site-wide excavation, monitoring, and removal phase, with the first phase being completed before beginning the second phase. The initial removal will be of the radiologically-impacted soils identified through the site walk-over gamma survey following removal of the asphalt cover. Those soils will be removed to apparently clean limits, at or below 7.1 pCi/g total radium. Excavation will utilize an excavator with a maximum 1 cubic yard (C.Y.) bucket. This bucket size will facilitate loading the transport containers without spilling and spreading the contamination. The excavations will be designated exclusion zones for purposes of health and safety requirements.

The removal of pesticide-contaminated soils from the Pesticide Impact Area will be coordinated with the removal of the radiologically-impacted soil. The radiologically-impacted soil in the Pesticide Impact Area will be removed to clean limits below 7.1 pCi/g. Some of the radiologically-impacted soils in the Pesticide Impact Area are known to have pesticide concentrations, and any such radiologically-impacted soils (including those containing pesticides) will be excavated and placed in boxes for transport and delivery to EnviroCare in Utah. The limits of the pesticide-impacted soils in the Pesticide Impact Area will be laid out on the basis of the previously completed borings. The pesticide-impacted soils in the Pesticide Impact Area will be marginally over-excavated in order to leave soils that are clean to the pesticide limits listed in TACO Tier 1 residential standards for ingestion or inhalation (whichever is lower) in 35 Ill. Admin. Code

Part 742, Appendix B, Table A for the following pesticides identified on-site: chlordane, aldrin, alpha-BHC, lindane, dieldrin, heptachlor, and heptachlor epoxide.

As the pesticide excavations are made, the soil will be screened for radioactivity in 18-inch lifts. Upon completion of the removal of all apparent pesticide-impacted soils in the Pesticide Impact Area, the limits of the excavations will be sampled and tested using the immunoassay field tests (Envirogard Soil Test Kit and Sample Extraction Kit protocols are included in the QAPP as SOP 500). The sampling frequency will take place every 100 square meters. The immunoassay tests will be run using a 3x dilution to match the TACO Tier 1 residential standard for inhalation and ingestion. Cleanup to this standard will allow for unrestricted development of the site.

Additionally, soil will be removed as needed from the Pesticide Impact Area to achieve compliance with the stipulated pesticide cleanup objectives. All pesticide-impacted soils which are not radiologically-impacted over the radiological cleanup standard will be disposed of at a landfill permitted to accept such soils. Pesticide-impacted soils will not be stockpiled on site but will be loaded into trucks for transport and off-site disposal on the day of excavation. Any soils temporarily stockpiled during the day prior to transport will be stockpiled in the interior of the site, avoiding the site margins.

Laboratory analysis will be provided to confirm the total concentrations of pesticides to document compliance with the pesticide cleanup levels once the apparent clean closure of the pesticide removal is demonstrated by field testing. Following receipt of the laboratory results indicating removal of all pesticide-impacted soil in the Pesticide Impact Area in excess of the stipulated cleanup objectives, the pesticide cleanup work in the Pesticide Impact Area will be considered completed and the excavation and screening for radiologically-impacted soil will continue.

The second phase of excavation will be to excavate and radiologically screen all of the fill soil within the site perimeter (except in the perimeter areas which have previously been radiologically cleared through soil borings as described in the Perimeter Drilling Report), and any of the underlying native soils which exhibit levels of radioactivity requiring removal and off-site management. This second phase will involve staging of non-radiologically impacted soil for use as backfill as the excavation progresses. Radiologically-impacted soil will be loaded into Supersacks and temporarily stored on-site until sufficient material is accumulated to warrant bringing a transport container to the site. Arrangements for the use of "Baker Boxes" will be made before construction starts; site mobilization will include provisions for the staging of these boxes as soon as they are needed. Staged material in Supersacks will be maintained in a secure location, on pavement or a membrane and covered to protect from wind and precipitation.

At present it is anticipated that the excavation will progress from the west end toward the east. This progression is anticipated based on the fact that it appears from current information that there is a larger area of impacted soil at the west end of the site. Therefore, this area may already have significant areas excavated and disrupted as a result of the first phase excavation. Excavating and screening the remaining portion of the west end of the site will allow this area to be released, regraded, and used as the temporary staging areas for non-radiologically impacted overburden and fill from the remainder of the project. Phase 2 material which is below the 7.1 pCi/g cleanup criteria and is used as backfill on-site will be spread, compacted and graded to provide a stable driving surface for staging soil and loading containers. Fill material will not be imported to bring the site back to its original grade.

Excavation will be limited to not more than 18 inches per lift followed by a survey for elevated gamma readings. This restriction is due to the shielding provided by soil which could preclude detecting impacted soil beneath a soil cover of 18 inches or more.

Excavation will proceed through all fill soils within the subject site except in the perimeter areas which have previously been radiologically cleared through soil borings as described in the Perimeter Drilling Report. The fill soils are underlain by natural soils consisting of medium to coarse sand and fine gravel. This natural soil will be screened to confirm no radiological impacts and will be subject to verification surveys and sampling by USEPA, in accordance with Section 3.1.7 of this Work Plan. Where floor slabs are present at the base of the fill, the slab will be broken and removed and the soil beneath the slab screened for verification and closure by USEPA. Concrete slabs, footings or walls encountered during the excavation will be cleaned of adhering contamination and after release as non-contaminated, will either be removed from the site or stockpiled on-site for subsequent management in connection with site development work. It is not proposed to bury these oversize pieces in the backfill.

In the deepest parts of the excavation, depths of 15 feet or more may be reached. These depths may encounter groundwater at a depth of 13 to 14 feet, based on previous borings. The potential for having to manage groundwater will be addressed through permitting from the Metropolitan Water Reclamation District of Greater Chicago (MWRDGC). Notice to and discharge permits from the MWRDGC and Chicago Department of Sewers will be provided prior to discharge of any water off site. It may be possible to manage the water on-site without the need to discharge to the city sewer system. Available information indicates that only a small part of the site, near the northeast corner, will have an excavation as deep as 15 to 16 feet. It may be possible to lower the water through excavated sumps, and pump the water to the west end of the site and use it as dust control, or simply let it infiltrate through the site fill soil.

### 3.1.6 Materials Management

Actions to manage removed material include all actions taken from the time the material is excavated until it reaches its final destination. Materials that are removed from the property may be replaced in their original locations, placed in another location on the property, salvaged, or sent to a local landfill if the materials meet the radiological clean-up criteria of 7.1 pCi/g total radium. Materials that do not meet the cleanup criteria will be sent to an approved disposal facility. At present, it is anticipated the radiologically-impacted material will be sent to EnviroCare of Utah, located in Clive, Utah. It is anticipated that all pesticide-impacted non-radiological materials will be disposed of at Waste Management CID landfill in Calumet City, Illinois.

Any trash and debris which TRS elects to remove from the site and which are not radiologically-impacted or pesticide-impacted will typically be placed into clean roll-off containers provided and collected by licensed trash removal and disposal companies. Radiologically-impacted and pesticide-impacted materials will be transported between the Site and the approved disposal facility according to DOT regulations. Procedures which will be used with respect to radiologically-impacted and pesticide-impacted materials to minimize the potential for and effects of spills and accidents during transport of such radiologically-impacted materials include but are not limited to the following:

- Drivers will have the proper licenses, training, and certifications for transporting potentially radioactive materials.

- Trucks transporting low-level radioactive materials in excess of 7.1 pCi/g total radium will have sealed or lined containment. Covers for the roll-off containers will be placed over the load prior to exiting the contaminated area. Covers will be fastened down tightly to prevent materials from being blown out of the containers. This will minimize the escape of materials should an accident occur. Empty containers returning to the site will also have covers. Trucks will carry all necessary papers and placarding. Containers will be inspected prior to loading to determine suitability.

- Trucks transporting pesticide-impacted soil will have covers. Covers for the trucks will be placed over the load prior to exiting the site. Covers will be fastened down tightly to prevent materials from being blown out of the trucks. Trucks will carry all necessary papers and placarding.

- Contaminated vehicles and equipment will be decontaminated first using broom cleaning to remove all adhering surface dirt. As needed, pressurized water spray will be used for further decontamination. Water generated during decontamination will be contained and evaporated or used for dust control, or possibly for disposal at an approved disposal facility.

- Prior to transporting excavated soils or other materials, all transport equipment will be frisked. Frisking will include tires and fenders and the sides and back of the bed. Frisking the cabs of trucks will not be necessary unless loading has been over the front of the truck.

- Travel between the property and the rail terminal will be only on specified routes selected to minimize the potential for and the effects of any accidents. Criteria used to select routes and Traffic Control procedures are described in Section 3.2 and Appendix 3 of this Work Plan.

- An Emergency Contingency Plan (Appendix 4) has been prepared for this project. This plan includes procedures to be implemented in the case of an accident. All truck drivers will be trained in and familiar with these procedures.

Three types of material will be distinguished in the excavated material:

- *Radiologically-impacted soil exceeding the clean-up threshold of 7.1 pCi/g total radium,*

- Non-radiological pesticide-impacted soil exceeding the pesticide clean-up threshold of the TACO Tier 1 residential standards for ingestion or inhalation

- Excavated soil suitable for backfill which is neither radiologically impacted in excess of 7.1 pCi/g total radium nor impacted by pesticides in excess of the TACO Tier 1 residential levels for inhalation and ingestion as specified in 35 Ill. Admin. Code Part 742, Appendix B, Table A.

There may be materials that will be specified by the owner as unsuitable for backfill, based on engineering properties, non-radiologic impacts, or other specifications. For this Work Plan, a distinction is proposed for radiologically-impacted materials and pesticide-impacted materials. Any disposal of non-radiologically impacted materials at any off-site location will comply with all applicable laws and regulations.

Soils which, based on visual or olfactory observations, are suspected to be grossly impacted by non-radiological contamination, will be temporarily staged at an interior location on-site to allow for sampling and characterization to provide for disposal permitting. These soils will be placed on liners and will be covered to minimize potential for erosion and spread of the material. To the extent possible the materials will be staged on pavement to minimize potential to impact underlying soils. The proposed staging area is shown on Figure 3-1.

Radiologically-impacted soil and pesticide-impacted soil excavated in Phase 1 will be loaded directly into containers. In Phase 2, it is anticipated the excavated quantities of material exceeding the radiological cleanup standard at individual locations will not fill a container. Where that is found to be the case, soil exceeding the radiological cleanup level will be temporarily stored in Supersacks until enough has accumulated to warrant delivery of a container. Where locations are encountered during Phase 2 where significant quantities of radiological material require removal, direct loading of containers will be resumed.

### 3.1.7 Verification Sampling

Soil exhibiting contamination above the clean-up threshold of 7.1 pCi/g total radium (Ra-226 + Ra-228) will be removed, placed in transport boxes as specified in the S&P documents, and shipped to Envirocare of Utah.

In order to demonstrate that the floors and sides of soil excavations meet cleanup criteria described in the UAO, a verification/field sampling program must be implemented following the excavation of the radiologically-impacted materials. The verification survey and sampling program will be conducted in general accordance with SOP-223.

Initial field demonstration that the location has been excavated to clean limits will be made with a 2 x 2 NaI detector which has been calibrated against the calibration blocks at the Kerr-McGee West Chicago facility. Pre-verification samples will then be collected and analyzed at an on-site laboratory using NUTRANL software and gamma spec analyses. Excavated locations will be screened in accordance with SOP-210.

Upon completion of the removal of all apparent pesticide-impacted soils from the Pesticide Impact Area, the limits of the excavations will be sampled and tested using the immunoassay field test methodology described in SOP 500. Samples will be taken every 100 square meters. The immunoassay tests will be run using a 3x dilution to match the TACO Tier 1 residential standard for inhalation or ingestion,

whichever is lower. Laboratory analysis will be provided to confirm the total concentrations of pesticides to document the cleanup levels once the apparent clean closure of the pesticide removal is demonstrated by field testing.

Detailed descriptions of the radiological verification sampling, analyses, and comparisons which will be done for this sampling are provided in Appendix 5 of this Work Plan. The excavations will not be backfilled until a signed radiological verification closure form is received from USEPA.

### 3.1.8 Description of Crews and Production Schedules

Construction activities have been identified in the previous sections of this Work Plan. These activities include surveying, radiological surveying and removal, pesticide removal, general excavation, and transportation. Personnel required to complete each of these activities have been grouped into crews, and the crews are described below. Subcontractors may be used for some work, such as fencing, concrete and paving work.

Personnel in addition to those described above will be necessary for this work. These personnel include health and safety personnel, quality inspectors, supervisors, and other management personnel. These personnel are described in the QAPP.

### 3.1.9 Survey Crew

A physical survey of the site has been previously been developed by a licensed land surveyor, including utilities, structures, property limits on both the site and the adjacent rights-of-way. Additionally, the Field Team Leader will locate and mark with signs, flagging, stakes, etc. the site 5 meter grids along the margins of the site.

### 3.1.10 Radiological and Pesticide Survey Crews

The radiological survey crew will be responsible for the initial site survey, surveys as the soil is excavated, surveys prior to the USEPA verification surveys and the surveys of equipment prior to leaving the site. The pesticide survey crew will delineate the Pesticide Impact Area, based on previous borings and monitor the removal to these limits. This crew will conduct the immunoassay field tests to assess whether the excavation has reached clean limits. This crew will take the verification samples for laboratory confirmation. These radiological and pesticide survey crews will typically be comprised of two persons,

and are required to have a minimum of two persons when working in exclusion zones, in accordance with the Health and Safety Plan.

### 3.1.11 General Excavation Crew

The general excavation crew will consist of the contractor's excavation personnel, and is anticipated to include as a minimum, the excavator operator, a laborer, and a truck driver. As excavation proceeds, additional operators, laborers and drivers may be added. As grading of non-radiologically impacted soil proceeds following the removal of the impacted soil, additional personnel will be present on site for that grading work. The size of the crew will depend on the size of the work area and the complexity of the work.

### 3.1.12 Production and Schedules

Work is proposed to be conducted during the 2002 construction season, and be completed before August 2002. An anticipated construction schedule is included as Figure 3-2.

The following presents the anticipated schedule and sequencing of the excavation and removal project. Note that certain tasks are required prior to the start of the removal effort, but are not detailed in this schedule and sequencing section. These include but may not be limited to the driveway permitting required prior to proceeding, and the logistical support such as site security, mobilization of office trailers, transportation containers, excavating equipment, and training of the contractor and subcontractor personnel.

- The perimeter and site interior guardrail will be removed. Guard rail posts and footings from below ground will be surveyed for radiological impacts. The perimeter fence has been installed and site grid has been established and marked.

- The utilities will be located and as necessary, cut-off and abandoned.

- The existing light poles on the site will be disconnected and removed.

- The asphalt stripping will begin. It is proposed to strip initially only the southwest portion of the site, retaining pavement along the north and east sides of the site. After the removal of radiologically-impacted materials from the southwest portion of the site and removal of pesticide-impacted soils

from the Pesticide Impact Area, and the completion of screening of surrounding soils in these portions of the site, the remaining portions of the site will be addressed for radiological materials according to the same procedures for removal and screening of radiological materials and in accordance with the sequence depicted on Figure 3-1.

- The asphalt and sub-base will be screened for radiological impacts as they are removed. The underlying soil will be surveyed as the asphalt and sub-base are removed.

- Removal of the identified radiologically-impacted soil will be performed first. In the southwest portion of the site, removal of the non-radiological pesticide-impacted soil will be performed second. The removal will proceed until all initially identified radiologically-impacted and pesticide-impacted soils have been removed.

- Preparation of the closure documentation report will begin upon removal of all identified radiologically impacted soil. This report will be submitted within 60 days of USEPA notice that all materials required to be removed pursuant to this Work Plan have been removed from the site.

### 3.2 Traffic Control

During the removal project, trucks carrying excavated impacted material will be traveling between the site and the rail terminal or Waste Management. Traffic from trucks carrying the radiologically-impacted soil will not be extensive, perhaps 5 to 10 with a maximum of 15 trucks a day, and may be conducted during nighttime hours when local traffic congestion is minimized. Trucks traffic carrying pesticide-impacted soil will be more extensive during the removal phase of these soils, perhaps 20 to 40 trucks a day. Trucks carrying pesticide-impacted soils will travel during the day from the site to the disposal site. Traffic controls will be implemented to minimize the potential for accidents to occur. A summary of the criteria which will be used to select the traffic routes is provided below.

- Routes will be adequate to support the loads. The selected route must be capable of supporting the loaded trucks. Routes with small light bridges and surfaces other than asphalt or concrete in good repair will be avoided wherever possible.

- Ease of travel. The route should minimize the number of stops and turns, and the streets should be sufficiently wide for two trucks to pass where other vehicles are parked on both sides of the street.

- Minimum other traffic. Major traffic routes should be avoided. The more traffic, the greater the potential for an accident to occur. Also, minor traffic routes generally have lower speed limits than major routes. Hours of hauling impacted materials to the rail terminal will be selected to avoid rush-hour traffic.

- Approval of the route. TRS or Kerr-McGee will prepare and submit proposed route maps to the City of Chicago Department of Transportation for approval of both the radiologically-impacted soil and the pesticide-impacted soil.

A detailed description of the Traffic Control Plan is provided in Appendix 2 of this Work Plan.

### 3.3 Site Security Plan

A detailed description of the Site Security Plan is provided in Appendix 6 of this Work Plan. This section provides a summary of the measures which will be taken to minimize the potential for accidents during the work. The work may create several potentially hazardous conditions. These conditions include but are not limited to the following:

- Open excavations
- Moving construction and excavation equipment
- Truck traffic

Only authorized persons will be permitted on-site. Authorized persons include the Project Manager, consultant personnel, contractors, subcontractors, and their representatives. USEPA personnel are authorized to be on-site subject to compliance with OSHA requirements and other reasonable safety precautions.

Visitors and other non-essential personnel may enter the work area only upon notice and authorization by the STS Project Manager or designee. This restricted access will ensure the STS Project Manager or designee can communicate to visitors appropriate safety information.

The site will be secured with a construction security fence around its entire perimeter. Gates will be provided at access points but will remain closed and locked when not in use and when there are no removal activities on-site.

Signs will be posted at a maximum of 100 foot intervals around the perimeter fence and at each access gate. The signs will read:

"UNDERGOING ENVIRONMENTAL REMOVAL ACTION

FOR FURTHER INFORMATION CONTACT

THOMAS PABIAN AT 312-573-5300

Your call will be returned during normal business hours.
Please leave your name and telephone number after the recorded message."

### 3.4 Health and Safety Plan

This section briefly describes the key personnel responsible for health and safety on the project, the types of hazards which might be encountered during the work to be done, the proposed training, and the personnel protective equipment (PPE) which may be worn for the potentially hazardous conditions which might be encountered.

#### 3.4.1 Key Personnel

While health and safety will be the concern of every person on the job, two persons will have health and safety as their primary concern. These persons are the Health and Safety Officer and the Field Team Leader. The responsibilities for these positions are detailed in the Health and Safety Plan, Attachment 3 to this Work Plan.

#### 3.4.2 Potential Hazards

Potential hazards which could be encountered during the removal activities include contaminated materials and the hazards associated with construction work. Contaminants of concern include the entire decay series for U-238 and Th-232 as well as exposure to pesticides, including chlordane, aldrin, lindane, dieldrin, heptachlor, and heptachlor epoxide. Clean-up criteria for radiologically-impacted soil are based on total radium, Ra-226 plus Ra-228. Clean-up criteria for pesticide-impacted soil are based on the TACO Tier 1 residential standards for ingestion or inhalation, whichever is lower, in 35 Ill. Admin. Code

Part 742, Appendix B, Table A. Radiologic and air monitoring as described in this Work Plan will be performed during excavation to further define the presence of radiological contaminants.

The mechanisms for exposure to these materials are direct exposure, inhalation, ingestion and eye/skin contact. The primary mechanism of exposure is direct exposure to external gamma radiation. All workers will be instructed in appropriate measures to protect against exposure to the above materials, and PPE will be worn until monitoring shows such is not necessary.

Physical hazards which might be encountered at this site include but are not limited to the following:

- Construction equipment (front-end loaders, back-hoes, trucks, compactors, bulldozers);
- Power tools (saws, drills, jack hammers, compactors);
- Heat and cold stress;
- Overhead power lines;
- Buried utilities;
- Excavations;
- Confined space;
- Noise;
- Demolition of structures; and
- Slip, trip and fall conditions, especially during wet or freezing periods.

### 3.4.3 Training

Site and project specific radiation and health and safety training will be provided for all on-site personnel prior to work on site. All personnel required to work in the Contamination Reduction Zone or the Exclusion Zone shall complete training conforming to the requirements of 29 CFR 1910.120(e) including

40 hours of initial hazardous waste site worker training. Where appropriate, they shall have 8 hours of annual refresher training, and 8 hours supervisors training. Field personnel shall complete radiation safety training in compliance with 32 IAC 400. This training shall include, at a minimum, 4 hours of training pertaining to radiation safety and awareness. Training will be conducted by a qualified safety specialist and/or a qualified senior health physics technician, at a minimum. The Project Training Program in included in Appendix 7. As noted in the Health and Safety Plan, Federal safety requirements take precedence over state requirements.

All site personnel will be trained and briefed on radiation basics, anticipated hazards, equipment to be worn, safety practices to be followed, contamination prevention practices, emergency procedures, radiation basics and communications. Procedures for leaving a contaminated area shall be planned and implemented prior to going on-site. Work areas and decontamination procedures will be established based on expected site conditions, and updated as necessary during construction.

In addition to this formal health and safety training, "tailgate" safety meetings will be held weekly, or more frequently, dependent on safety issues arising during the project. These meetings may be led by the worker"s foremen and every employee must sign in before beginning work for the week. The subject covered and persons present will be recorded for each meeting and kept as part of the project records. Health and safety incidents and monitoring results will be discussed in the tailgate safety meetings, when appropriate.

Visitors to the site will be briefed on the requirements of the Health and Safety Plan before being allowed within the work area, and will be accompanied by a foreman or supervisor whenever possible.

### 3.4.4 Personnel Protective Equipment (PPE)

Based on information from previous investigations of site conditions, it is anticipated that most excavation work can be done in Level D PPE. Level D PPE for this project consists of hard hat, steel-toed work shoes or boots, work gloves and safety glasses. Coveralls will be required for all work in exclusion zones. Prior to exiting any exclusion zones, personnel will go through decontamination, disposal of all appropriate PPE, and frisking procedures as described in the Health and Safety Plan.

### 3.4.5 Monitoring

A primary goal during the removal activities will be to control radioactive and pesticide particulates from the excavation, earth moving, and other activities on-site. A primary requirement of dust control is "no visible dust". Fugitive dust generation is caused by a range of activities including excavation, loading, dumping, transporting and scraping using heavy equipment such as bulldozers, front-end loaders, trucks and graders. Traffic along roadways causes resuspension of particulates.

An Air Monitoring Plan is included as Appendix 8 to this Work Plan. The principal objectives of the air monitoring activities are to:

- Ensure worker and general population safety and provide radiological control information;
- Evaluate work procedures and site control measures. In addition to identifying the need for corrective action, air monitoring also documents the effectiveness of such control actions;
- Measure releases of airborne radioactivity (should any occur) and ensure that people living and working in the surrounding area are not exposed to radiation above acceptable limits.

Air monitoring will be conducted at two levels. Site perimeter monitoring will be conducted at the four sides of the site (north, south, east, and west). This air monitoring is for the purpose of documenting, and if detected, initiating measures to control off-site airborne contamination. Air monitoring will be conducted in accordance with the Air Monitoring Procedure, SOP 212.

Personal air monitoring will be required for workers in an exclusion zone. Procedures for personal air monitoring are presented in the Health and Safety Plan included in Attachment 3.

### 3.5 Application of ALARA to Excavation

The clean-up criteria established is 5 pCi/g total radium (Ra-226 + Ra-228) above the background. Background for this area has been established on vicinity sites as 2.1 pCi/g, resulting in a clean-up criteria of less than or equal to 7.1 pCi/g total radium. Areas found to contain total radium in excess of the action criterion will be included in the removal activities. Averaging over areas up to 100 square meters is allowed, but only after reasonable efforts have been made to achieve as low as reasonably achievable

(ALARA) levels. The principle of keeping ALARA radiation doses consistent with economic and social constraints also applies to the removal activities.

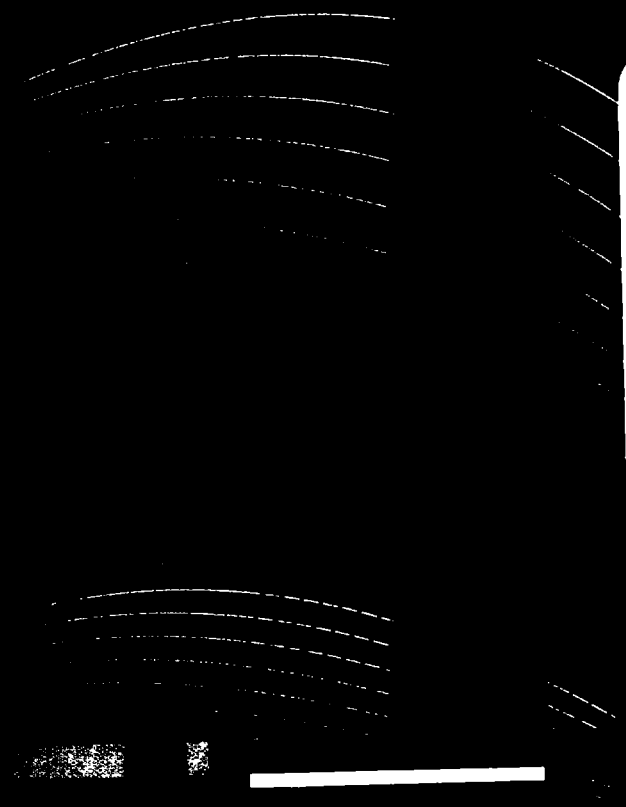
ALARA and the numerical criterion will be met through a coordinated program of surveys and verification conducted by TRS. USEPA will provide oversight role in the application of ALARA to the excavation activities.

### 3.6 Data Management

Data management for the site, as related to excavation activities, consists of health physics data, soil radioactivity data and civil construction and excavation data (i.e., land surveys, excavation volume estimates, etc.). Given the relatively short anticipated duration of the excavation activities for this project, data can be effectively managed utilizing the paper records required by this Work Plan.

An on-site or site vicinity field laboratory will be used to analyze soil samples as excavation and removal proceeds, and for pre-verification sampling that the radiological clean-up criteria have been met. Analytical records will be kept at the site and at the Vernon Hills, Illinois offices of TRS's contractor, STS Consultants, Ltd. Air monitoring analyses will be maintained at both the site and STS's offices, and will be transmitted with the monthly project progress reports to USEPA.

# The Infrastructure Imperative



**Attachment 2**

Revised Organizational Chart (Figure 2-1)

# PROJECT MANAGEMENT ORGANIZATION CHART

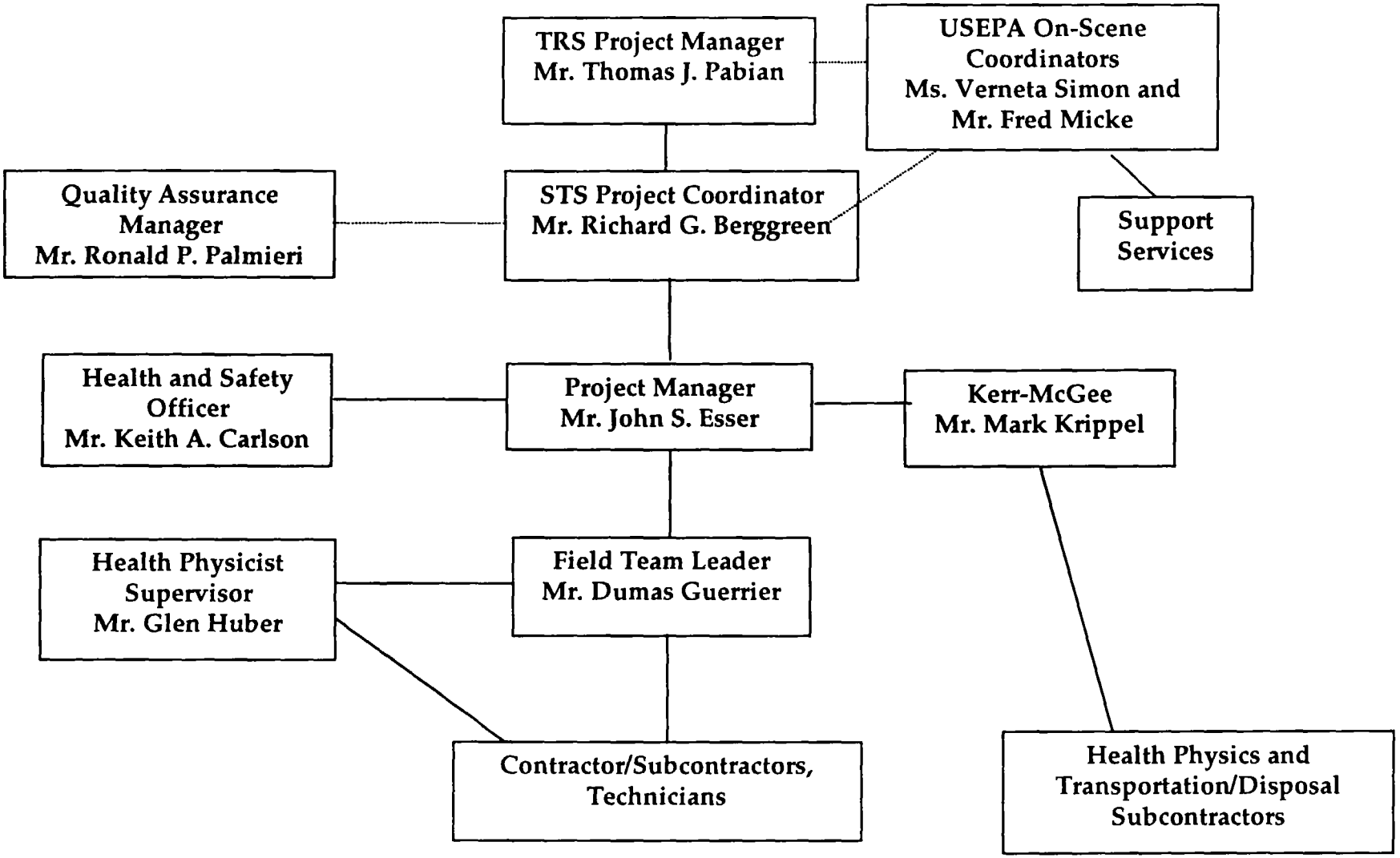
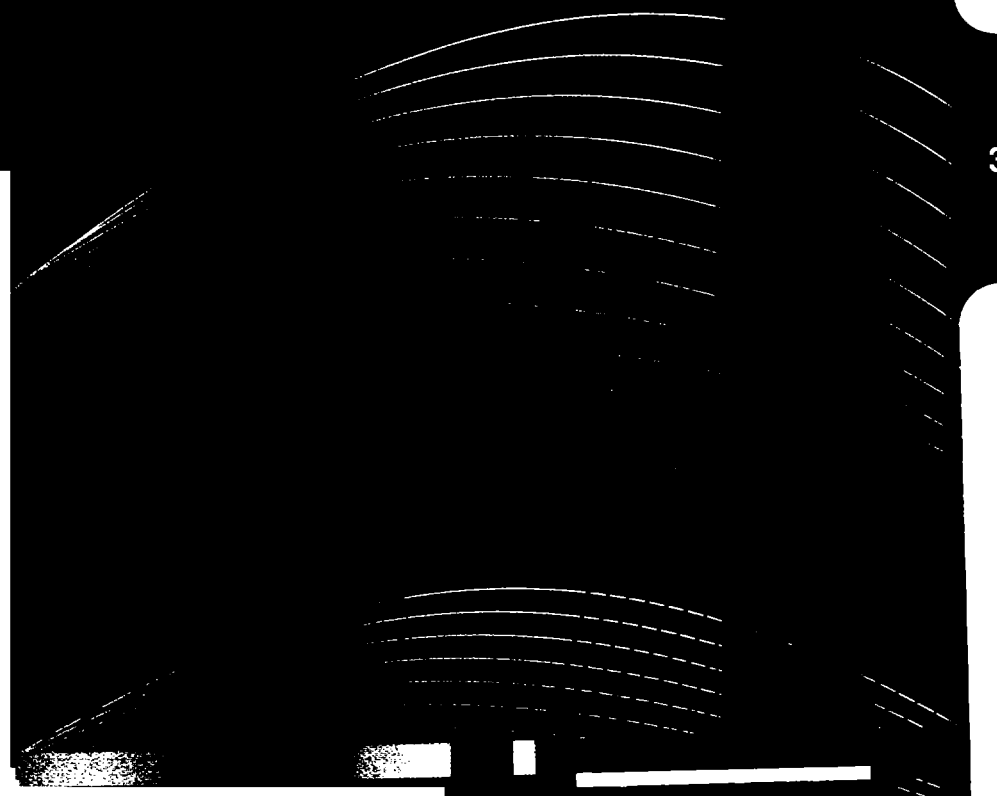





Figure 2-1

# THE INFRASTRUCTURE IMPERATIVE



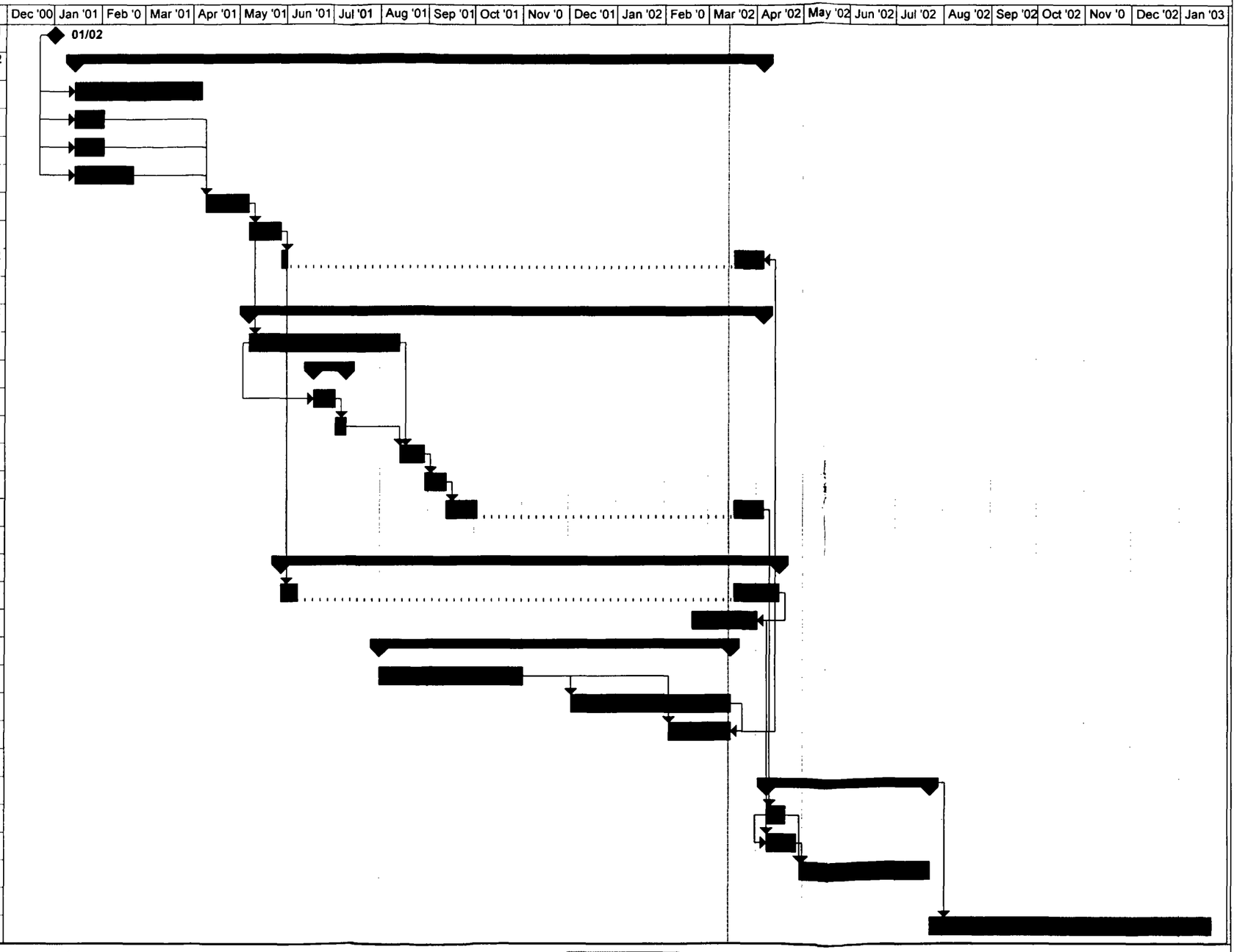


**Attachment 3**

Revised Construction Schedule (Figure 3-2)

# GMO Site - Preliminary Schedule
## STS Project No. 25585-XG

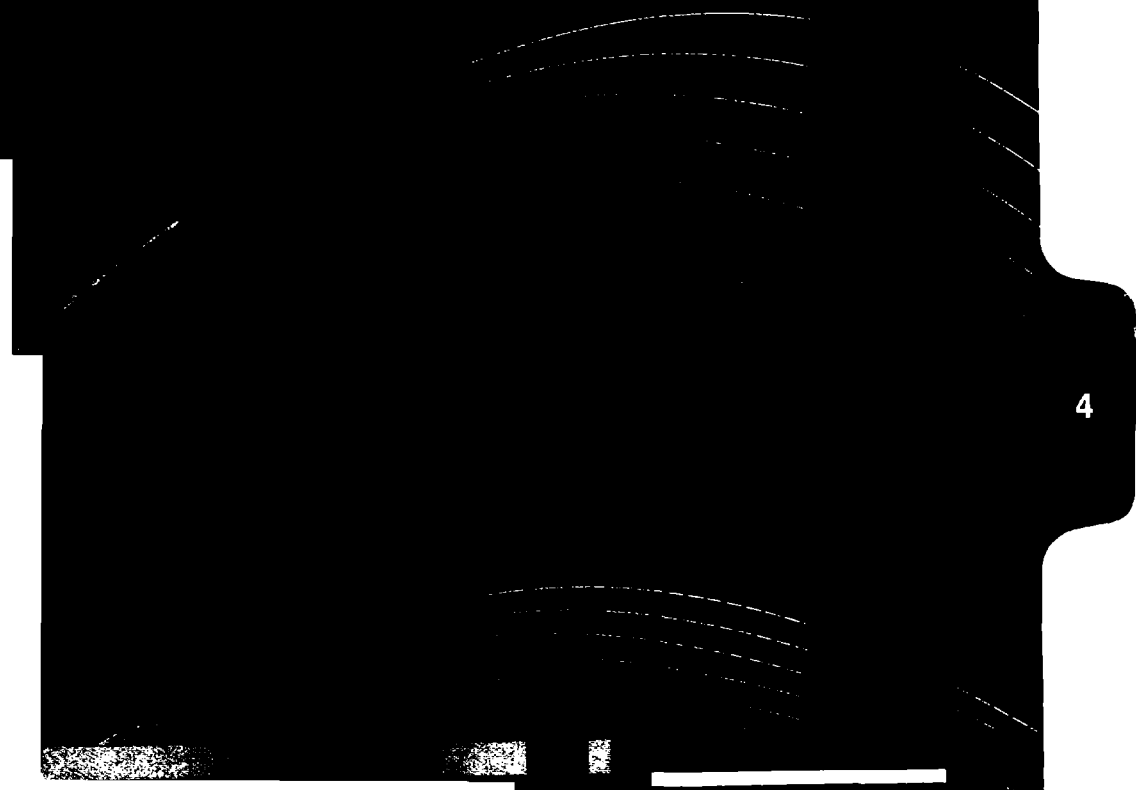
| ID | Task Name | Duration | Start | Finish |
|---|---|---|---|---|
| 1 | Receive Project Authorization | 0 days | Tue 01/02/01 | Tue 01/02/01 |
| 2 | **WORK PLAN DEVELOPMENT:** | **320 days** | **Mon 01/15/01** | **Fri 04/05/02** |
| 3 | Develop Work Plan | 60 days | Mon 01/15/01 | Fri 04/06/01 |
| 4 | I.D. ROW & Onsite Utils. | 15 days | Mon 01/15/01 | Fri 02/02/01 |
| 5 | Time-Life Substructure As-Built Condition | 15 days | Mon 01/15/01 | Fri 02/02/01 |
| 6 | Draft Plan | 28 days | Mon 01/15/01 | Wed 02/21/01 |
| 7 | USEPA Review/Response | 20 days | Tue 04/10/01 | Mon 05/07/01 |
| 8 | Revise Plan & Submit Final Draft | 15 days | Tue 05/08/01 | Mon 05/28/01 |
| 9 | Agency Approval | 19 days | Tue 05/29/01 | Fri 04/05/02 |
| 10 | | | | |
| 11 | **REMEDIATION BID PACKAGE:** | **239 days** | **Tue 05/08/01** | **Fri 04/05/02** |
| 12 | Develop Documents | 70 days | Tue 05/08/01 | Mon 08/13/01 |
| 13 | **Owners Review** | **15 days** | **Tue 06/19/01** | **Mon 07/09/01** |
| 14 | Review at 50% | 10 days | Tue 06/19/01 | Mon 07/02/01 |
| 15 | Review at 100 % | 5 days | Tue 07/03/01 | Mon 07/09/01 |
| 16 | Revise Bid Package | 12 days | Tue 08/14/01 | Wed 08/29/01 |
| 17 | Solicit Contractor Bids | 10 days | Thu 08/30/01 | Wed 09/12/01 |
| 18 | Review/Negotiation & Award Contract | 29 days | Thu 09/13/01 | Fri 04/05/02 |
| 19 | | | | |
| 20 | **PERMITS/APPROVALS:** | **230 days** | **Tue 05/29/01** | **Mon 04/15/02** |
| 21 | Department of Underground Approval | 30 days | Tue 05/29/01 | Mon 04/15/02 |
| 22 | Driveway/Sidewalk Permit | 30 days | Tue 02/19/02 | Mon 04/01/02 |
| 23 | **Pesticide Contamination Resolution** | **163 days** | **Wed 08/01/01** | **Fri 03/15/02** |
| 24 | Testing for Pesticides | 67 days | Wed 08/01/01 | Thu 11/01/01 |
| 25 | Obtain USEPA Concurrence | 75 days | Mon 12/03/01 | Fri 03/15/02 |
| 26 | Revise Work Plan | 30 days | Mon 02/04/02 | Fri 03/15/02 |
| 27 | | | | |
| 28 | **CONSTRUCTION:** | **77 days** | **Mon 04/08/02** | **Tue 07/23/02** |
| 29 | Clear Utilities | 10 days | Mon 04/08/02 | Fri 04/19/02 |
| 30 | Mobilization/Site Preparation | 15 days | Mon 04/08/02 | Fri 04/26/02 |
| 31 | Implement Remediation Plan | 62 days | Mon 04/29/02 | Tue 07/23/02 |
| 32 | | | | |
| 33 | **PROJECT CLOSE OUT:** | 130 days | Wed 07/24/02 | Tue 01/21/03 |




Project: GMO Site
Date: Thu 03/14/02

Task — Milestone — Rolled Up Split — External Tasks — Deadline
Split — Summary — Rolled Up Milestone — Project Summary
Progress — Rolled Up Task — Rolled Up Progress — External Milestone

# THE INFRASTRUCTURE IMPERATIVE



**Attachment 4**

Health and Safety Plan, Revision 2

# TEACHERS' RETIREMENT SYSTEM - GMO SITE

## HEALTH AND SAFETY PLAN

## ATTACHMENT 3

Title: Health and Safety Plan

Revision Number: 2

Date: February 14, 2002

Replaces: Version 1

## TABLE OF CONTENTS

**TABLES**



**FIGURES**

## EMERGENCY PHONE NUMBERS

**IN THE EVENT OF AN EMERGENCY DIAL 911**

| | |
|---|---|
| AMBULANCE SERVICE | 911 |
| FIRE DEPARTMENT | 911 |
| EMERGENCY RESCUE SERVICE | 911 |
| POLICE DEPARTMENT | 911 |
| NATIONAL RESPONSE CENTER | 1-800-424-8802 |
| POISON CONTROL CENTER | *1-800-732-2200* |
| NORTHWESTERN MEMORIAL HOSPITAL | (312) 908-2000 |
| ILLINOIS DEPARTMENT OF NUCLEAR SAFETY (IDNS) EMERGENCY NUMBER | (217) 785-0600 |
| PROJECT COORDINATOR (Richard Berggreen) | (847) 279-2500 |
| ILLINOIS EMERGENCY MANAGEMENT | (217) 782-7860 |
| USEPA REGION 5 24-HOUR EMERGENCY NUMBER | (312) 353-2318 |

## 1.0 SCOPE OF PLAN

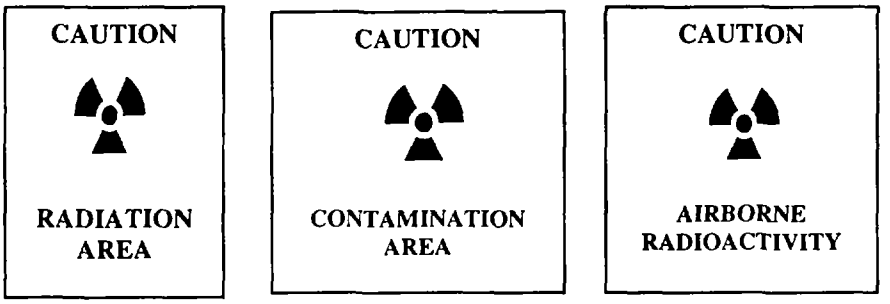
The following Health and Safety Plan (HASP) will be utilized and modified as necessary in order to minimize and prevent exposures to hazardous substances and conditions related to all excavation and restoration activities at the GMO site (Site). All personnel assigned to this project will be required to review thoroughly the contents of the HASP and to strictly adhere to the policies and procedures listed herein. This HASP is for use only by the Teachers' Retirement System of the State of Illinois (TRS) their designated contractors and consultants, and approved Site visitors. USEPA, and other agencies, are not considered visitors and will be required to conform to their own Health and Safety Plans.

This plan meets the requirements of OSHA 29 CFR 1910.120, Hazardous Waste Operations and Emergency Response, and applicable subparts of OSHA 29 CFR 1926, 1910 and 10 CFR. Visitors will be required to review the health and safety plan and read and sign the visitor information sheet (Figure 1.1).

FIGURE 1.1
VISITOR INFORMATION SHEET

NOTICE TO VISITOR: ALL VISITORS MUST BE ESCORTED AT ALL TIMES WHILE ON THIS SITE.

CAUTON. Radioactive materials may be present on this site. Radioactive materials may be found throughout the site. Grounds, buildings and equipment have low levels of contamination.




CONTROLLED AREAS: Do not enter areas with these signs unless you have an escort or health physics has given specific approval and you understand access limitations.

You must wear protective clothing in controlled areas. Health physics will provide you with instructions.

You must wear a personal radiation dosimeter if you enter an area which is controlled.

No smoking, eating, drinking or chewing in controlled areas.
NO EXCEPTIONS.

.Notify Health Physics if you do not understand these instructions.

Figure 1.1

## 2.0 SAFETY MANAGEMENT

The following safety management structure, Figure 2.1, will be utilized for the implementation, administration, and monitoring of the HASP.

### 2.1 Health and Safety Coordinator

The Health and Safety Coordinator (HSC), Mr. Keith Carlson, shall assume overall responsibility for the HASP. The HSC or designee shall monitor and maintain quality assurance of the HASP until project completion. Principal duties of the HSC include:

- Review project background data,
- Approve all HASP modifications,
- Administer and enforce the HASP,
- Evaluate the adequacy of personal protective equipment (PPE) to be used by Site personnel,
- Conduct required on-site training except tailgate safety meetings that will be conducted by the Field Team Leader (Mr. Dumas Guerrier),
- Brief visitors on work Site conditions, and
- Administer personnel and perform ambient air monitoring procedures.

The HSC or designee has the authority to stop work in the event conditions develop which pose an unreasonable risk to Site personnel or persons in the vicinity.

## PROJECT MANAGEMENT ORGANIZATION CHART

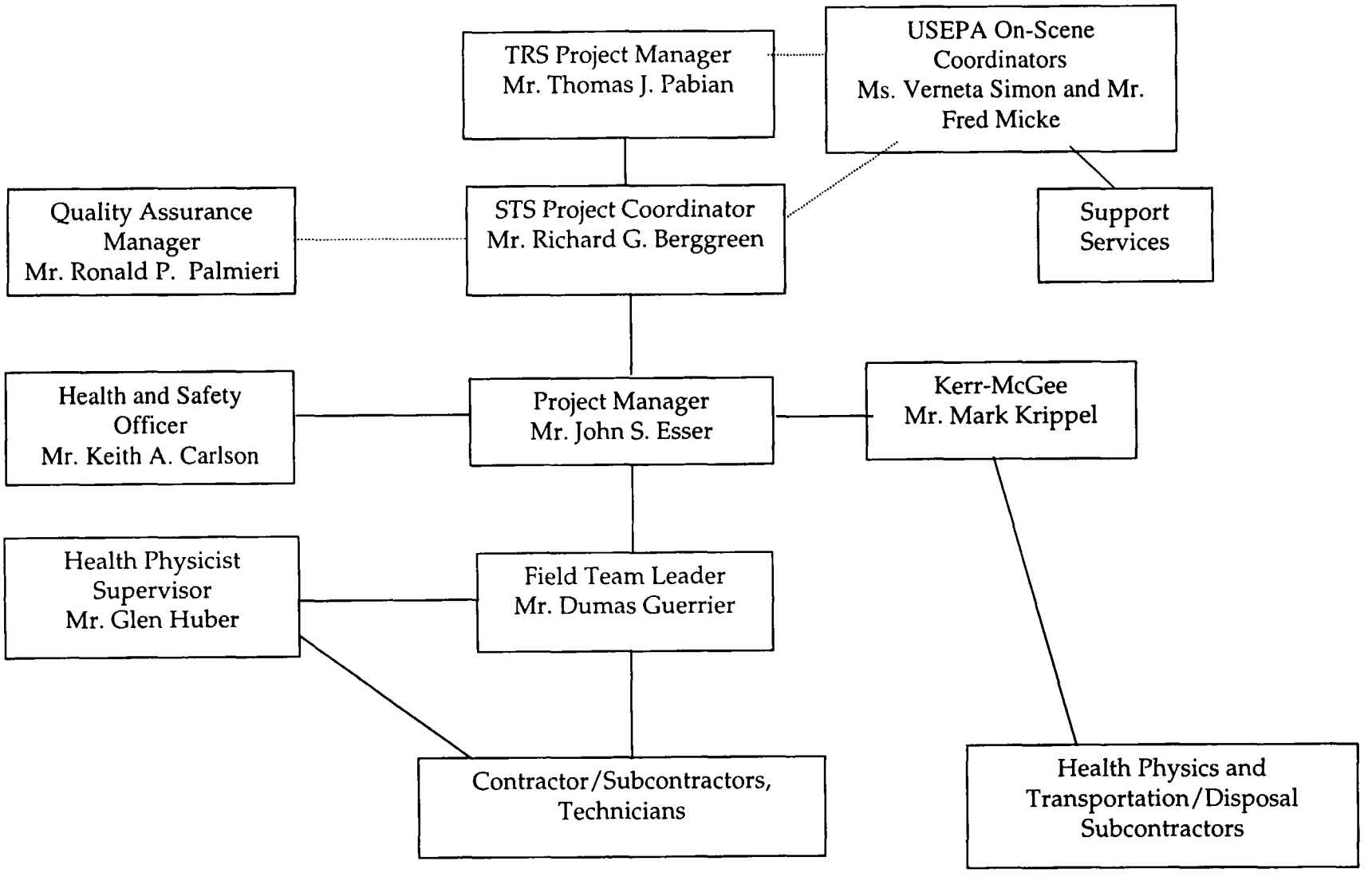



Figure 2.1

## 3.0 PERSONNEL RESPONSIBILITIES

The HSC or designee will administer and supervise the HASP at the work-site level. He will monitor all operations and will be the primary on-site contact for health and safety issues, and will have full authority to stop operations if conditions are judged to be hazardous to on-site personnel or the public.

The HSC will brief all Site personnel on the contents of the HASP. Personnel will be required to review the HASP, and have the opportunity to ask questions about the planned work or hazards. The Field Team Leader, Mr. Dumas Guerrier, will conduct tailgate safety meetings to familiarize the Site personnel with Site conditions, boundaries, and physical hazards. Site personnel will conduct their assigned tasks in accordance with the HASP at all times. As necessary, the Field Team Leader will conduct radiation training and provide briefings on radiation issues that arise during construction. These activities will take place as part of the tailgate safety meetings, or during special meetings to address more immediate concerns, dependent on the issues being addressed.

If at any time Site personnel observe unsafe conditions, faulty equipment or other conditions which could jeopardize personnel health and safety, they are required to immediately report their observations to the HSC or Field Team Leader.

Work zones will be established at the Site. These zones include clean/support zones, decontamination zones, and exclusion zones. Known impacted areas where exclusion zones are to be established during the removal effort are shown on Figure 3.1. Although the clean/support zones are anticipated to remain fixed, other zones will move about the Site as excavation work progresses.

Figure 3.1 - Impacted Areas Where Exclusion Zones May Be Established

## 4.0 HAZARD ASSESSMENT

The following represents potential hazards associated with this project.

### 4.1 Principal Contaminants (Known or Suspected)

Radioactive Contamination

- Thorium: the entire thorium (Th-232) decay chain
- Uranium: the entire uranium (U-238) decay chain
- Radium: Ra-226 and Ra-228
- Radon: Rn-220 and Rn-222

The known total radium concentration present in the soil exceeds 3000 pCi/g for some locations within the project site. The following primary routes of entry to the body will be considered:

| ROUTE | ENTRY MADE VIA: |
|---|---|
| Inhalation | Airborne dust containing heavy metal radionuclides and radon. |
| Ingestion | Airborne dust containing heavy metal radionuclides/contaminants. |
| | Improper or poor personal hygiene practices. |
| Eye and Skin | Direct contact with contaminants. |
| | Improper or poor personal hygiene practices. |
| | Airborne dust containing heavy metal/radionuclide contaminant. |
| | Cuts and abrasions. |
| Direct Exposure | Penetrating gamma radiation in air and soil. |
| | Exposure to X-rays. |

Chemical Contamination

- Chlordane and Related Pesticides

Chlordane was formerly used as an insecticide. It is a persistent organochlorine compound that was banned by the EPA in 1990. Exposure to high concentrations of chlordane via inhalation, ingestion and skin contact is hazardous. Chlordane is a suspect carcinogen. Actual chlordane hazard on this site is considered low because of its concentration in the soils and low vapor pressure (0.00001 mmHg).

The use of personal protective equipment, proper procedures and dust suppression activities will minimize any hazard to site personnel from either the elevated radioactivity or chlordane contamination. Specific safety procedures will be covered in subsequent sections of this Site Safety Plan.

| Route | Entry Made Via |
|---|---|
| Inhalation | Airborne dust |
| Ingestion | Airborne dust |
| | Improper or poor personal hygiene |
| Skin and Eye | Direct contact with contaminated soil |
| | Improper or poor personal hygiene |
| | Airborne dust |
| | Cuts and abrasions |

## 4.2 Physical Hazards

Before field activities begin, the HSC will conduct a Site reconnaissance to identify any real or potential hazards created from Site activities. Physical hazards inherent to construction activities and power-operated equipment may exist.

### 4.2.1 Heat Stress

Field activities in hot weather create a potential for heat stress. The warning symptoms of heat stress include fatigue; loss of strength; reduced accuracy, comprehension and retention; and reduced alertness and mental capacity. To prevent heat stress, personnel shall receive adequate water supplies and electrolyte replacement fluids, and maintain scheduled work/rest periods.

The Field Team Leader or designee shall continuously visually monitor personnel for signs of heat stress. In addition, field personnel will be instructed to observe for symptoms of heat stress and methods on how to control it. One or more of the following control measures can be used to help control heat stress.

- Provision of adequate liquids to replace lost body fluids. Employees must replace body fluids lost from sweating. Employees must be encouraged to drink more than the amount required to satisfy thirst, 12 to 16 ounces every half-hour is recommended. Thirst satisfaction is not an accurate indicator of adequate salt and fluid replacement. Replacement fluids can be commercial mixes such as Gatorade.
- Establishment of a work regimen that will provide adequate rest periods for cooling down. This may require additional shifts of workers.
- Breaks should be taken in a cool and shaded rest area (77 degrees is best).
- Employees shall remove impermeable protective garments during rest periods.

- Employees shall not be assigned other tasks during rest periods.

- All employees shall be informed of the importance of adequate rest, acclimation, and proper diet in the prevention of heat stress.

4.2.2 Cold Stress

Field activities are anticipated during cold weather during a period when temperatures average below freezing. The following guidelines will be followed.

Persons working outdoors in temperatures of 40 degrees and below may suffer from cold exposure. During prolonged outdoor periods with inadequate clothing, effects of cold exposure may even occur at temperatures well above freezing. Cold exposure may cause severe injury by freezing exposed body surfaces (frostbite) or result in profound generalized cooling, possibly causing death. Areas of the body which have high surface area-to-volume ratios such as fingers, toes and ears are the most susceptible to frostbite.

Two factors influence the development of a cold injury: ambient temperature and the velocity of the wind. Wind chill is used to describe the chilling effect of moving air in combination with low temperature. For instance, 10° F with a wind of 15 miles per hour (mph) is equivalent in chilling effect to still air at -18°F.

As a general rule, the greatest incremental increase in wind chill occurs when a wind of 5 mph increases to 10 mph. Additionally, water conducts heat 240 times faster than air. Thus, the body cools suddenly when external chemical-protective equipment is removed if the clothing underneath is perspiration-soaked.

Local injury resulting from cold is included in the generic term "frostbite". There are several degrees of damage. Frostbite of the extremities can be categorized into:

- Frost nip or incipient frostbite: Characterized by sudden blanching or whitening of skin.
- Superficial frostbite: Skin has a waxy or white appearance and is firm to the touch, but tissue beneath is resilient.
- Deep frostbite: Tissues are cold, pale, and solid; extremely serious injury.

Prevention of frostbite is vital. Keep the extremities warm. Wear insulated clothing as part of one's protective gear during extremely cold conditions. Check for symptoms of frostbite at every break. The onset is painless and gradual - you might not know you have been injured until it is too late.

To administer first aid for frostbite, bring the victim indoors and rewarm the areas quickly in water 95° to 100°F. Give individual a warm drink - not coffee, tea, or alcohol. The victim should not smoke. Keep the frozen parts in warm water or covered with warm clothes for 30 minutes, even though the tissue will be very painful as it thaws; then elevate the injured area and protect it from injury. Do not allow blisters to be broken. Use sterile, soft, dry material to cover the injured areas. Keep victim warm and get immediate medical care.

### 4.2.3 Electrical Hazards

Overhead power lines, downed electrical wires, buried cables and improper use of electrical extension cords can pose a danger of shock or electrocution. All Site personnel should immediately report to the Field Team Leader any condition that could result in a potential electrical hazard.

The Field Team Leader will notify Site personnel during the safety meetings of the locations of known underground cables and utilities.

### 4.2.4 Noise Hazard

Operation of equipment may present a noise hazard to workers. Site personnel will utilize hearing protection when noise levels are determined to be in excess of 29 CFR 1910.95 requirements. Noise monitoring will be performed by the HSC as needed.

### 4.2.5 Overt Chemical Exposure

Typical response procedures include:

SKIN CONTACT:
Use copious amounts of soap and water. Wash/rinse affected area thoroughly, then provide appropriate medical attention. Eye wash will be provided on-site at the work zone and support zone as appropriate. If affected, eyes should be continuously flushed for a minimum of 15 minutes.

INHALATION:
Move to fresh air and transport to hospital. Decontaminate as other actions permit.

INGESTION:
Transport to emergency medical facility. Decontaminate as permitted by other requirements.

PUNCTURE WOUND OR LACERATIONS:
Transport to emergency medical facility. Field Team Leader will provide chemical safety information to medical personnel as requested. Decontaminate as permitted by other requirements.

#### 4.2.6 Adverse Weather Conditions

In the event of adverse weather conditions, the Field Team Leader will determine if work can continue without endangering the health and safety of field workers. Some items to be considered before determining if work should continue are:

- Potential for heat stress and heat-related injuries.
- Potential for cold stress and cold-related injuries.
- Treacherous weather-related working conditions.
- Limited visibility.
- Potential for electrical storms or high winds.

### 4.3 Medical Evaluation and Surveillance Program

All field project personnel shall receive a medical evaluation in accordance with 29 CFR 1910.120. Personnel who receive a medical evaluation will be notified by the medical contractor as to the outcome of their evaluation. This will be in the form of a confidential report addressed to the individual and will contain a breakdown of the clinical findings. In addition, it will indicate any areas of concern which would justify further medical consultation by the individual's personal physician. In the event that the areas of concern are of a severe nature, a follow-up notification will be made to the individual by the medical consultant to answer any questions the employee may have.

#### 4.3.1 Dosimetry/Personnel Monitoring

All project personnel shall participate in a dosimetry program administered by the HSC. (The dosimetry program shall comply with 32 IAC 340[1] , i.e. dosimeters shall be processed by a dosimetry processor accredited by the National Voluntary Laboratory Accreditation

[1] The IDNS regulations are usually more restrictive than US Nuclear Regulatory Commission (NRC) regulations. However, if there is a conflict between IDNS and NRC regulations, the NRC regulations will be used to determine compliance.

Program.) The HSC shall maintain records of all radiation exposures incurred by field personnel including all contractors. These records will be maintained in an up-to-date manner to comply with the requirements of 32 IAC 340.4010. The HSC shall review the results of personal exposure monitoring to determine compliance with exposure limit requirements.

### 4.3.2 Requirement for Dosimetry

Personal dosimetry is required for anyone who enters a radiologically controlled area in which he/she may receive in one calendar year a dose in excess of 10% of the limits in 32 IAC 340. Any person who works in a radiation area will be required to have a personal dosimeter. As a matter of policy, all individuals shall be required to use a dosimeter (either self-reading type, film badge or Thermoluminescence Detector (TLD)) whenever they enter the Exclusion Zone.

### 4.3.3 Bioassay

Bioassay is the determination of the types and amounts of radioactive materials, which are inside the body. By analyzing the rate of deposition, the rate of excretion, and any other available information regarding placement in the body, internal exposures from radioactive materials can be estimated.

Procedures for bioassay will be consistent with the previous Lindsay Light Health and Safety Plan. Bioassays are not anticipated to be required for the excavation and removal activities proposed, based on levels documented as present.

The decision to use bioassay shall be made by the Health and Safety Coordinator. In the event that a worker has an excessive intake or the potential to receive greater than 10% of the Annual Limit on Intake (ALI) , bioassay shall be ordered. Data from Lapel Air Samplers

shall be used as a factor in determining whether or not bioassay is warranted. If workers are found to have been present in locations where airborne radioactivity concentrations are found to be greater than 30% of the Derived Air Concentration, bioassay will be considered.

### 4.3.4 Emergency Medical Treatment

Emergency first aid should be administered on-site as appropriate. The individual should be decontaminated if possible, depending on the severity of the injury, and transported to the nearest medical facility, if needed. Treatment of the injury is of primary concern and decontamination a secondary concern. Levels of radioactive contamination at the Site could be acutely hazardous if decontamination is not undertaken during an emergency situation. The Field Team Leader will complete the appropriate incident report, if warranted. See Section 4.4, Accident and Incident Reporting.

An emergency first-aid station will be established and will include a first-aid kit for onsite emergency first aid.

Provisions for emergency medical treatment shall be integrated with the following guidelines:

- At least one individual qualified to render first aid and Cardiopulmonary Resuscitation (CPR) will be assigned to each shift.
- At least one individual trained in radiation emergency response will be assigned to each shift
- Emergency first aid stations in the immediate work vicinity.
- Conspicuously posted phone numbers and procedures for contacting ambulance services, fire department, police, and medical facilities.
- Maps and directions to medical facilities.

- Conspicuously posted evacuation routes and gathering area locations shall be posted around the Site.

## 4.4 Accident and Incident Reporting

All accidents, injuries, or incidents will be reported to the HSC. This accident/incident will be reported as soon as possible to the employee's supervisor. An Accident/Incident Form will be completed by the Field Team Leader, and a copy will be forwarded to the STS Project Manager. A copy of the form is shown as Figure 4.1.

**FIGURE 4.1**
**ACCIDENT/EXPOSURE INVESTIGATION REPORT**

| | | | |
|---|---|---|---|
| COMPANY | | | DATE |
| INVESTIGATION TEAM | | | |
| EMPLOYEE'S NAME & ID | | | |
| SEX | AGE | JOB DESCRIPTION | |
| DEPARTMENT & LOCATION | | | |
| ACCIDENT DATE & TIME | | | |
| DATE & TIME ACCIDENT REPORTED TO SUPERVISOR | | | |
| NATURE OF INCIDENT | | | |
| NATURE OF INJURY | | | |
| REFERRED TO MEDICAL FACILITY/DOCTOR ☐ YES ☐ NO | | | |
| EMPLOYEE RETURNED TO WORK ☐ YES DATE/TIME _____ ☐ NO | | | |
| ☐ INJURED EMPLOYEE INTERVIEW/STATEMENT - ATTACHED | | | |
| WITNESSES | | | |
| | | | |
| ☐ WITNESSES INTERVIEWS/STATEMENTS ATTACHED | | | |
| ☐ PHOTOGRAPHS OF SITE - ATTACHED | | | |
| ☐ DIAGRAMS OF SITE - ATTACHED | | | |
| EQUIPMENT RECORDS - ATTACHED - REVIEWED | | ☐ YES | ☐ NO |
| ACCIDENT/EXPOSURE INCIDENT DESCRIPTION | | | |
| | | | |
| | | | |
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**FIGURE 4.1**
**ACCIDENT/EXPOSURE INVESTIGATION REPORT**

| | | |
|---|---|---|
| ACCIDENT DESCRIPTION | | |
| | | |
| | | |
| DATE & TIME | LOCATION | |
| EMPLOYEES INVOLVED | | |
| PREVENTIVE ACTION RECOMMENDATIONS | | |
| | | |
| | | |
| | | |
| | | |
| CORRECTIVE ACTIONS COMPLETED | MANAGER RESPONSIBLE | DATE COMPLETED |
| | | |
| | | |
| | | |
| | | |
| EMPLOYEE LOST TIME - TEMPORARY HELP - CLEANUP - REPAIR - DISCUSSION | | |
| ACCIDENT COST ANALYSIS | INVESTIGATION | COMPLIANCE / TOTAL COST |
| MEDICAL | | |
| PRODUCTION LOSS | | |
| REPORT PREPARED BY | DATE COMPLETED | |
| SAFETY COMMITTEE REVIEW | ☐ YES | ☐ NO |
| CORRECTIVE ACTION | DATE STARTED | |
| SAFETY COMMUNICATION NOTICE PREPARED | DATE | |
| SAFETY DIRECTOR SIGNATURE | | |

**FIGURE 4.1**
**ACCIDENT/EXPOSURE INVESTIGATION REPORT**

| ACCIDENT DESCRIPTION | |
|---|---|
| | |
| | |
| DATE & TIME | LOCATION |
| EMPLOYEES INVOLVED | |
| | |
| EMPLOYEE INTERVIEW/STATEMENT - INJURED EMPLOYEE - WITNESS | |
| EMPLOYEE NAME | |
| | |
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| | |
| | |
| | |
| | |
| INTERVIEWED BY | |

ACCIDENT DIAGRAM/PHOTOGRAPHS

## 5.0 TRAINING

All Site personnel shall be trained and certified in accordance with 29 CFR 1910.120.

### 5.1 Project- and Site-Specific Training

Prior to project start-up, all assigned personnel shall receive an initial project- and site-specific training session. This training shall include, but not be limited to, the following areas:

- Review of the Health and Safety Plan;
- Review of general radiation principles and compounds;
- Review of applicable radiological chemical and physical hazards;
- PPE levels to be used by Site personnel;
- Site security control;
- Emergency response and evacuation procedures;
- Project communication;
- Required decontamination procedures;
- Prohibited on-site activities;
- Instructions to workers in accordance with 10 CFR 1912; and
- U.S. NRC Regulatory Guide 8.13 and Declared Pregnant Woman Policies (Females).

## 5.2 Visitor Orientation

All non-essential personnel and visitors who plan to enter the exclusion zone will be briefed on the HASP requirements and 10 CFR 1912 requirements prior to entry with a trained Site escort. In addition, female visitors will be instructed regarding U.S. NRC Regulatory Guide 8.13 and Declared Pregnant Woman Policies.

## 5.3 Safety Tailgate Meetings

Before the start of the work week, on Monday morning, the Field Team Leader will assemble the Site personnel for a brief safety meeting. Additional meetings will be conducted throughout the week, as needed, to address safety concerns and precautions. The purpose of these meetings will be to discuss project status, problem areas, conditions, safety concerns, PPE levels and to reiterate HASP requirements. The Field Team Leader will complete a Safety Meeting Report (Figure 5.1) to indicate the contents of the meeting and the attendees.

## 5.4 First Aid

At least one (1) individual, trained and qualified to administer first aid and CPR in accordance with American Red Cross requirements, who is also trained in radiological response, will be present at the Site.

## 5.5 Safe Work Permit

Site workers in special work conditions such as confined space, hot work, trenching, or other physical hazards, must be skilled at such work and trained to recognize these as special work conditions. Confined space is defined by OSHA 1910.146. Section 13 of this HASP contains further information on the confined space program to be followed.

Figure 5.2 shows the Safe Work Permit to be completed by the HSC and signed by workers for special work conditions.

Figure 5.3 show the issues which will be addressed in the event soil is encountered which exhibits low level contamination. The potential low level contamination includes the presence of chlorinated pesticides, possible residual petroleum products from an existing or former underground storage tank or other source of fuel or polynuclear aromatics (PNAs) contamination, such as tar, cinders, or coal ash.

# FIGURE 5.1
# SAFETY MEETING REPORT (Page 1 of 2)

| DATE | | DURATION OF MEETING | |
|---|---|---|---|
| | | FROM: ☐ A.M. ☐ P.M. | TO: ☐ A.M. ☐ P.M. |
| NUMBER PRESENT | NUMBER ABSENT | MEETING CONDUCTED BY | DID MEETING INCLUDE REQUIRED TRAINING? ☐ YES (DESCRIBE BELOW) ☐ NO |

| | |
|---|---|
| **HEALTH AND SAFETY COORDINATOR'S PRESENTATION** | DISCUSSION OF SAFE/UNSAFE WORK PRACTICES, MATERIALS, PRECAUTIONS, HAZARDS, EQUIPMENT FAMILIARIZATION, ETC. |
| **SITE WORKER FEEDBACK** | COMMENTS, QUESTIONS, COMPLAINTS, ETC. |
| **HEALTH AND SAFETY COORDINATOR'S CORRECTIVE ACTION PLAN** | KNOWN PLANS FOR CORRECTION, PARTS ON ORDER, ITEMS TO BE DISCUSSED WITH DEPART. HEAD, AND CORRECTION OF ITEMS PREVIOUSLY SUBMITTED |
| **PROJECT MANAGER'S COMMENTS** | RESOLUTION OF QUESTIONS, ITEMS OR ISSUES RAISED IN MEETING OR WITH SUPERVISOR |

| | |
|---|---|
| HEALTH AND SAFETY COORDINATOR | PROJECT MANAGER |
| FIELD TEAM LEADER | HAVE SITE WORKERS ATTENDING SIGN ON REVERSE SIDE. FORWARD A COPY TO THE PROJECT COORDINATOR |

FIGURE 5.1

## SAFETY MEETING REPORT (PAGE 2 OF 2)

| TO BE SIGNED BY ALL SITE WORKERS ATTENDING THE MEETING | | | |
|---|---|---|---|
| I HAVE RECEIVED AND UNDERSTAND THE INFORMATION AND/OR TRAINING INDICATED ON THE REVERSE SIDE. | | | |
| **SIGNATURE** | **DATE** | **SIGNATURE** | **DATE** |
| | | | |
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| LIST ALL SITE WORKERS ABSENT FROM THE MEETING | |
|---|---|
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| | |

# FIGURE 5.2
# SAFE WORK PERMIT (Page 1 of 2)

COMPLETED PERMIT MUST BE POSTED AT THE ENTRY OR WORK SITE.

| ISSUED BY | DATE | TIME (FROM) ☐ A.M. ☐ P.M | TIME (TO) ☐ A.M. ☐ P.M. |
|---|---|---|---|
| | | | |

| ACCEPTED BY | RESPONSIBILITY TRANSFERRED TO (NAME) |
|---|---|
| LIST ALL WORKS (ON BACK) OR ATTACH ROSTER | |

**SECTION 1 — GENERAL AREA WORK PERMIT**

1. WORK LIMITED TO THE FOLLOWING: (DESCRIPTION AND AREA/EQUIPMENT)

2. SAFETY EQUIPMENT (OTHER THAN AREA REQUIREMENTS) ☐ NONE

☐ RAIN SUIT ☐ GLOVES ☐ FACE SHIELD ☐ GROUND FAULT CIRCUIT INT. ☐ AIR PACK (SCBA) ☐ FIRE RESISTANT CLOTHING
☐ CHEMICAL SUIT ☐ HEARING PROTECTION ☐ HOOD ☐ BARRICADES/WARNING SIGN ☐ SUPPLIED AIR ☐ LONG SLEEVES
☐ RUBBER BOOTS ☐ CHEMICAL GOGGLES ☐ FALL RESTRAINT DEVICE ☐ COMMUNICATIONS EQPT (EST) ☐ RESPIRATOR ☐ OTHER

3. THE PERSON RECEIVING THE PERMIT VERIFIES THAT ALL WORKERS:

| | | | |
|---|---|---|---|
| A. HAVE BEEN THROUGH THE SAFETY ORIENTATION | ☐ YES | E. KNOW THE LOCATION OF THE PHONE OR INTERCOM | ☐ YES |
| B. UNDERSTAND APPLICABLE HAZCOM AND RADIATION REQUIREMENTS | ☐ YES | F. KNOW THE PROCEDURES FOR SAFE JOB COMPLETION | ☐ YES |
| C. HAVE DISCUSSED HAZARDS OF THE JOB AND AREA | ☐ YES | G. HAVE INSPECTED ALL TOOLS/EQUIPMENT | ☐ YES |
| D. KNOW THE LOCATION/USE OF SAFETY EQUIPMENT | ☐ YES | H. UNDERSTAND THE CLEAN UP REQUIREMENTS | ☐ YES |

PERMIT RECEIVER INITIALS _____

4. POTENTIALLY AFFECTED AREA PERSONNEL AND WORKERS NOTIFIED OF WORK TO BE DONE ☐ YES ☐ N/A

5. THE FOLLOWING RESPONSIBILITIES HAVE BEEN COMMUNICATED TO THE PERSON RECEIVING THIS PERMIT:

| | | |
|---|---|---|
| ☐ CONDITIONS FOR WORK STOPPAGE | ☐ PERFORMING THE WORK SAFELY | ☐ COMPLETION OF SECTION 6 AND PERMIT RETURN |
| ☐ CREW ACCOUNTABILITY | ☐ REPORTING CHANGES THAT AFFECT JOB SAFETY | |

**SECTION 2 — AIR TESTS**

PRIOR TO ENTRY OR HOT WORK ☐ DOES NOT APPLY

TEST IN ORDER INDICATED

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1. OXYGEN METER TEST PERFORMED | ☐ YES ☐ N/A | READING | %$O_2$ | RANGE 19.5-23.5% $O_2$ | TESTED BY | LOCATION OF TEST | TIME ☐ AM ☐ PM |
| 2. COMBUSTIBLE GASES AND VAPORS TEST | ☐ YES ☐ N/A | READING | %LEL | MAXIMUM 10% LEL | TESTED BY | LOCATION OF TEST | TIME ☐ AM ☐ PM |
| 3. TESTS FOR TOXICS | ☐ YES ☐ N/A | READING | ☐ PPM ☐ MA/M³ | PEL/TLV ☐ PPM ☐ MA/M³ | TESTED BY | LOCATION OF TEST | TIME ☐ AM ☐ PM |

**SECTION 3 — HOT WORK**

☐ DOES NOT APPLY

| | YES | N/A | | YES | N/A |
|---|---|---|---|---|---|
| 1. FIRE EXTINGUISHER (TYPE) _____ IS IT FULL? | | | 8. GROUND LEAD ATTACHED TO WORK | | |
| 2. SURVEY AREA FOR COMBUSTIONS AND OPENINGS, HOSES, TRENCHES, ETC. | | | 9. PREVENTION OF HEAT EXPOSURE TO GASKET, SEALS, LINERS | | |
| 3. COMBUSTIBLE MATERIALS REMOVED OR PROTECTED | | | 10. OTHER WORK IN AREA WHICH SHOULD BE STOPPED | | |
| 4. HEAT/SPARK CONTROL - TARPS, COVERS, WATER, ETC. | | | 11. MATERIAL PRESENT WHICH EMITS VAPOR WHEN HEATED | | |
| 5. PRECAUTION TAKEN FOR HIDDEN COMBUSTIBLES | | | 12. RADIANT HEAT TRANSFER CONSIDERED | | |
| 6. PURGE GAS USED. TYPE _____ | | | 13. EQUIPMENT OPERATING OR CONTAINS ORIGINAL CONTENTS | | |
| 7. ADJACENT AREAS SAFE/SEWERS PROTECTED | | | 14. DUCTS OR CONVEYORS PLUGGES OR PROTECTED | | |

**SECTION 4 — CONFINED SPACE**

☐ DOES NOT APPLY

| | YES | NO | N/A | | YES | NO | N/A |
|---|---|---|---|---|---|---|---|
| 1. CONFINED SPACE ENTRY REQUIRED? | | | | 5. HAVE AUTHORIZED ENTRANTS SIGNED OPPOSITE SIDE OF THIS FORM? | | | |
| 2. SPACE TO BE ENTERED _____ | | | | 6. HAVE DESIGNATED ATTENDANTS SIGNED OPPOSITE SIDE OF THIS FORM? | | | |
| 3. PURPOSE OF ENTRY _____ | | | | 7. HAVE ALL NECESSARY HAZARD CONTROL MEASURES BEEN TAKEN? | | | |
| 4. IS SPACE A PERMIT-ENTRY SPACE? IF YES, COMPLETE OPPOSITE COLUMN | | | | 8. HAS ALL REQUIRED EQUIPMENT BEEN PROVIDED? | | | |

**SECTION 5 — TRENCHING/EXCAVATION**

☐ DOES NOT APPLY

| | YES | NO | N/A | | YES | NO | N/A |
|---|---|---|---|---|---|---|---|
| 1. HAS THE AREA BEEN INSPECTED FOR UNDERGROUND POWER LINES OR PRODUCT LINES? | | | | 4. HAVE PRECAUTIONS BEEN TAKEN IF THE TRENCH/EXCAVATION DEVELOPS INTO A CONFINED SPACE? | | | |
| 2. DOES THE TRENCH REQUIRE SHORING/BRACING/SUPPORT? | | | | 5. HAVE OVERHEAD POWER/PRODUCT LINES BEEN REMOVED OR IDENTIFIED? | | | |
| 3. HAS THE SOIL BEEN EVALUATED FOR STABILITY? | | | | 6. WILL LEAKING WATER OR RAIN WATER AFFECT THE STABILITY OF THE TRENCH/EXCAVATION? | | | |

# SAFE WORK PERMIT (Page 2 of 2)

| SECTION 6 | | | YES | NO | N/A | | YES | NO | N/A |
|---|---|---|---|---|---|---|---|---|---|
| | QUESTIONS TO BE COMPLETED ON PERMIT EXPIRATION OR JOB COMPLETION. | 1. HAS THE JOB BEEN COMPLETED? | | | | 5. HAVE SAFETY DEVICES BEEN REINSTALLED? | | | |
| | WORKER CLOSEOUT SIGNATURE | 2. HAS THE AREA BEEN CLEANED OF WORK MATERIAL? | | | | 6. HAS HOT WORK AREA BEEN SURVEYED FOR SMOLDERING MATERIALS? | | | |
| | TIME ☐ AM ☐ PM | 3. HAVE MANAGEMENT PERSONNEL BEEN INFORMED JOB IS DONE? | | | | 7. SPECIAL PRECAUTIONS, CONCERNS OR REMARKS | | | |
| | | 4. HAVE ALL LOCKS AND/OR TAGS BEEN REMOVED? | | | | COMMENTS: | | | |

**OBSERVERS, WATCHERS, RESCUERS**

I HAVE BEEN INSTRUCTED AS A CONFINED SPACE ATTENDANT, SAFETY WATCHER OR RESCUER AND UNDERSTAND MY DUTIES.

| SIGNATURE | DATE | SIGNATURE | DATE |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

**PERSONS AUTHORIZED TO PERFORM WORK AND/OR TO ENTER CONFINED SPACE**

I HAVE BEEN INSTRUCTED IN AND AM AWARE OF THE POSSIBLE HAZARDS AND CONDITIONS I MAY ENCOUNTER IN THIS ENTRY WORK

| SIGNATURE | TIME | | DATE | SIGNATURE | TIME | | DATE |
|---|---|---|---|---|---|---|---|
| | IN | OUT | | | IN | OUT | |
| | | | | | | | |
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**COMMENTS**

**AUDIT PURPOSE ONLY**

**CORRECTIVE ACTIONS**

**COMPLETED BY**

| NAME | TITLE | DATE |
|---|---|---|
| | | |
| | | |
| | | |

**FIGURE 5.3**
**SITE SAFETY PLAN**
**LOW CONTAMINATION OF FUEL,**
**CHLORINATED PESTICIDES AND PNAs IN SOILS**

SUMMARY INFORMATION

DATE: _____ UPDATE: _____

PROJECT NAME: _____ PROJECT NO: _____

LOCATION: _____

SITE CONTACT AND PHONE NUMBER: _____

TYPE OF FACILITY: (active or inactive - describe previous use, previous agency action, soil type, topography, surrounding community)

PLAN PREPARED BY: _____

SITE SAFETY OFFICER: _____ CPR/FIRST AID TRAINED STAFF: _____

REVIEWED BY: _____ DATE: _____

WORK SCOPE/CONSTRUCTION/INVESTIGATION
Task 1 _____
Task 2 _____
Task 3 _____

PROPOSED START DATE: _____

UNUSUAL FEATURES/SITE SECURITY (include site map): _____

UTILITIES: ☐ Marked ☐ Scheduled Meet Date _____ Time _____

ANALYTICAL DATA (to be summarized below or attached, if available)

_____

_____

CONFINED SPACE: ☐ Yes ☐ No (If yes, describe and address permitting and entry procedures in an attachment.) _____

_____

AIR MONITORING:
Monitoring equipment: HNu meter with 10.2 eV lamp or _____
Action level = 15 PID units in breathing zone for Level C upgrade. Stop work = 50 PID units in breathing zone.
☐ $0_2$ meter, ☐ FID, ☐ Detector tubes, ☐ L.E.L. meter, ☐ Other _____

Other action levels: _____

PERSONAL PROTECTION: Level of Protection: ☐ A ☐ B ☐ C ☐ D
Special Requirements _____

COMMUNICATION EQUIPMENT: (Mobile Phone or other phone location and number, etc.)

_____

Scheduled Safety Meetings Interval: (daily, weekly, as needed)

SPECIAL SITE EMERGENCY COMMUNICATION PROCEDURES: (Evacuation signals, routes, spill containment)

HEAT/COLD STRESS CONTROLS:

SPECIAL PHYSICAL HAZARD CONTROLS: Barricades for work area, reflective vests, other, etc.

_____

**LOCAL EMERGENCY RESOURCES and telephone numbers**
Emergency Eye Wash/Shower Location:
Fire Extinguisher: _____
Police: _____
Fire Department: _____
Poison Control: _____
**HOSPITAL**: _____
Address: _____
Telephone: _____
Directions (supply map): _____
_____

EMERGENCY CONTACTS (name and phone number)
1. Construction Manager Contact: _____
2. Owner Contact: _____
3. Contractor Contact: _____
4. Subcontractor Contact: _____
5. Subcontractor Contact: _____
6. _____
7. _____

PRE-ENTRY SAFETY BRIEFING
I have received and read the _____ Low Contamination Health and Safety Plan. I understand the plan and had the opportunity to ask questions. I understand the information and instructions in the plan. I understand that medicine can complicate the effects from exposure to toxic chemicals. If I am taking any prescription or over the counter medicine or have a current medical condition which may increase my risks, I will advise my supervisor or Site Safety Officer.

| Signature | Responsibility | Date |
|---|---|---|
| _____ | _____ | _____ |
| _____ | _____ | _____ |
| _____ | _____ | _____ |

# 6.0 COMMUNICATIONS

## 6.1 General Communications

The Field Team Leader will have available at the Site the means for telephone communications, or an equivalent means of communication, for summoning emergency assistance from the fire/ambulance and police departments in the event they are required. The telephone will also act as a direct link to technical personnel for information pertaining to all phases of the project.

## 6.2 Radio/Telephones

Short-range walkie-talkies or cellular telephones will be made available to designated personnel working at the Site.

## 6.3 Emergency Warning

In the event of an emergency condition, the Field Team Leader will notify project personnel verbally if all are within immediate hearing and via a bullhorn if the Site area is large. The Field Team Leader will also notify visitors present within the area. Site personnel will immediately proceed to a pre-designated assembly area as designated by the Field Team Leader during the daily safety meeting. Personnel will remain in the designated area until further instructions are received by the Field Team Leader.

All communication equipment will be tested at the beginning of each day to verify operational integrity.

## 6.4 Hand Signals

Hand signals will be used by field teams in conjunction with the buddy system. Hand signals shall be familiar to the entire field team before operations commence and should be reviewed during site-specific training.

| Signal | Meaning |
|---|---|
| Hand gripping throat | Out of air; can't breathe |
| Grip partner's wrist | Leave area immediately; no debate |
| Hands on top of head | Need assistance |
| Thumbs up | OK; I'm all right; I understand |
| Thumbs down | No; negative |

## 6.5 Site Security

Only authorized personnel will be permitted on the Site in accordance with the requirements of the Site Security Plan (Appendix 6 to the Removal Action Work Plan) and this HASP. Visitors and other non-essential personnel may enter the work area only upon authorization by the Field Team Leader. This restricted access will ensure that the Field Team Leader can communicate with each person authorized to enter the work area.

## 7.0 PERSONNEL EXPOSURE AND AIR QUALITY MONITORING

### 7.1 Air Quality (Dust)

Due to the nature of the principal contaminants associated with the project (radiation and chlordane), dust suppression will be important as a means of minimizing exposure levels and off-site migration of contaminants. A key control measure to minimize exposure levels and off-site migration of contaminants will be a policy of "no visible dust". The Field Team Leader will routinely monitor the project area. Acceptable dust levels (controlling all visible dust) will result in airborne dust levels of less than 1 $mg/m^3$. The OSHA nuisance dust standard of 15 $mg/m^3$ is not acceptable at this site, because of contaminants in the dust.

### 7.2 Airborne Radioactivity Monitoring

Monitoring for airborne radioactivity exposure is as important as monitoring for external radiation exposure. Monitoring for airborne radioactivity exposure requires the following elements:

- Air sampling for radioactive particulates,
- Recordkeeping regarding personnel work locations and time in location,
- Respiratory protective equipment records regarding devices used by workers in airborne radioactivity areas,
- Counting and analyzing air sample filters,
- Calculating air concentrations of radioactive material, and
- Comparing air concentrations to applicable air quality criteria

By closely monitoring these three elements, a continuous record of personnel exposure to airborne radioactivity is maintained.

Lapel samplers worn for personal air monitoring shall be utilized for airborne radioactivity monitoring any time a worker enters a radiological exclusion zone. The filters from the lapel samplers shall be analyzed the following day after use for comparison purposes to assess the need for procedural changes. It is expected that naturally occurring radon and thorium daughters will interfere with analyses. Additional evaluation of samples shall be performed when determined necessary based upon elevated results. If sample analysis shows concentrations greater than background levels a follow-up analysis shall be performed. The follow-up analysis shall be performed after four days to allow for the decay of the thoron daughter Pb-212 (10.6 hour half life). The "four day count" should be free from radon daughter interference and will serve as the official measurement of Th-Alpha.

High volume air samplers shall be utilized so that effluent air quality can be gathered on a daily basis. High volume air sampling allows for much shorter collection times than low volume sampling and has equivalent dust loading for needed collection durations. Both high and low volume air samplings require a sufficient volume of air to be collected in order for the Minimum Detectable Activity (MDA) to be below the most restrictive air effluent guidelines. Daily analysis of samples will allow for necessary procedural changes to be made and alert health and safety staff to potential problems on a continuous basis, rather than once per week.

Time decay of interfering nuclides generally refers to radon-222 decay and daughters but may also include thoron decay. The specific times for decay of samples are best addressed in procedures rather than in the health and safety plan.

After filters have been collected and decayed overnight, there will be a morning count of the filter that will serve to identify high gross counts for the previous day. This will alert health and safety staff of a potential problem which they can investigate more promptly. The count, after 4 days decay, will serve to be the official measurement of Th-Alpha.

## 7.3 Internal Monitoring

Internal monitoring to determine intakes of radioactive material will be performed as needed based upon the results of the air sampling program. Bioassay methods to be considered should include in-vivo, as well as in-vitro, assessments. Routine bioassay of workers is not anticipated based upon the low concentrations of radioactivity in soils to be excavated.

## 7.4 External Radiation Monitoring

External radiation monitoring of workers will be performed using film badges or thermoluminescent dosimeters. Dosimetry will be provided and processed by a service holding National Voluntary Laboratory Accreditation Program (NVLAP) certification. Pocket dosimeters may also be utilized for visitors and other infrequent personnel requiring access to the Site.

## 7.5 Radiological Surveys

Radiological surveys will be performed to ensure that radiation levels and contamination levels are within applicable guidelines for workers and the general public. Radiation surveys will be performed using the following instrumentation:

- Ludlum Model 2221 Portable Scaler/Ratemeter with 2"x2" NaI probe (or equivalent). This instrument will be used to conduct surface soil scans. Instrument specific action levels shall be used to determine approximate radiological soil concentrations. Any areas where the count rate is greater than the determined action level shall be considered exclusion zones and marked appropriately.

- Ludlum Model 3 Survey Meter with pancake G-M probe (or equivalent). This instrument will be used to conduct surveillance surveys of both personnel and equipment leaving exclusion zones. The action level for both equipment and personnel surveys is any count rate that exceeds background level. Decontamination procedures detailed in section 9.0 of the HSP will be used when contamination is located.

- Ludlum Model 3 Survey Meter with 1"x1" NaI probe "MicroR meter" (or equivalent) and Eberline Model RO-2 Ion Chamber (or equivalent). These instruments will be used periodically to ensure that dose rates in work areas as well as the Site perimeter are below prescribed levels. The action levels for both on and off site are detailed in Section 7.8 of the HSP in Table 7.1

Airborne radioactivity measurements will be performed as described in the Air Monitoring Plan (Appendix 8 to the Removal Action Work Plan).

## 7.6 Contamination Monitoring

Samples shall be obtained periodically in work areas to ensure that radioactivity is present at acceptable levels and is prevented from leaving the Site. Decontamination of elevated areas will be performed to maintain contamination at levels that are ALARA.

Before leaving the exclusion zone, Site personnel shall be checked through use of a hand-held frisker to ensure that contamination is not present on skin or clothes. The frisker will be a Ludlum Model 3 survey meter with a pancake G-M probe (or equivalent). The Field Team Leader will be immediately informed regarding any contamination on individuals and will initiate appropriate decontamination techniques. Proper disposition of contaminated personal effects and clothing also will be the responsibility of the Field Team Leader.

## 7.7 Total Organic Vapor Monitoring

In addition to the radiological contaminants, there is a very slight potential of encountering organic vapors. Thus, no routine screening for organic vapors will be conducted during the removal action. However, if organic odors are encountered during the field work screening for total organic vapors will be conducted with a photoionization detector (PID), or similar type equipment, on a daily basis. The screening will evaluate ambient photoionization volatile organic vapors and some semivolatile organic vapors.

Total organic vapors in ambient air will be obtained periodically with a PID during daily field activities. The PID provides real-time readings of exposure to volatile organics and some semi-volatile organics. Measurements will be made daily, prior to activities, to determine background levels. Monitoring measurements will be taken when:

- operations change,
- work moves to a different portion of the Site, and
- personnel observe contaminated materials.

These screening operations will be used to identify conditions requiring an upgrade to full-face respirators as described in Section 7.8.2.

## 7.8 Action Levels

### 7.8.1 Radiological Action Levels

Radiological action levels for on-site workers will be determined by performing surveillance surveys as well as airborne particulate monitoring for the presence of radioactivity. Properly trained Health Physics Technicians will perform radiological monitoring. The radioactive contamination on the Site is particulate and insoluble in water.

Therefore, there will be no fixed contamination on the workers. Action levels as determined by radioactive monitoring can be found in Table 7.1.

To avoid the need for upgrade of personal protection equipment due to airborne contamination, engineering controls such as the use of water to minimize dust levels will be implemented as necessary during excavation and restoration activities.

### 7.8.2 Organic Vapors Action Levels

STS Consultants, Ltd. is taking a conservative approach to organic vapor monitoring at the Site. A PID will be used to periodically monitor for organic vapors or when odors indicated the possibility of organic contamination. Operations will be discontinued if the PID reads 5 ppm or greater above background and the area will be evacuated. The Site Health and Safety Officer will retest the area wearing a full-face respirator. Operations will not resume until the PID reads less than 5 ppm, and remains below 5 ppm.

**TABLE 7-1**
**ACTION LEVELS AS DETERMINED BY RADIOACTIVITY**

Note:

Personnel shall not be exposed to airborne radioactivity such that their weekly intake exceeds 12 Derived Air Concentration (DAC)-hours without prior approval of the Field Team Leader or designee.

Level of protection may be increased to Level C (full-face air purifying respirator) when airborne monitoring indicates that contamination levels have reached 30% of the DAC. All assessments shall incorporate ALARA principles. Engineering controls shall be used prior to assignment of respiratory protective equipment.

Signs shall be posted at entrances to areas where airborne radioactivity levels exceed, or have the potential to exceed, 25% of the DAC.

The most restrictive DAC of the nuclides which may be present onsite is Th-232. The DAC for Th-232 Class W is $5x10^{-13}$ uCi/ml. The air effluent limit is $4x10^{-15}$ uCi/ml. Engineering controls will be utilized so that no visible dust is present and airborne radionuclide concentrations will be kept ALARA.

| Radiation Type | Action Level | Level of Respiratory Protection/Action |
|---|---|---|
| a. Contamination on smear samples of equipment | 33 dpm/100 $cm^2$ gross alpha | Decontamination required prior to release for unrestricted use. |
| b. Contamination surveys of personnel or equipment | Count rate greater than background levels | Decontamination required prior to leaving exclusion zone. |
| c. Airborne Radioactivity | 30% DAC[(c)] | Consider Level C (full-face APR) based upon ALARA evaluation. Ensure proper posting. Consider internal monitoring |
| d. Ambient Gamma (work areas) | 5 mrem/hr[(d)] | Consider procedures for shielding of soils. Ensure proper posting. |
| e. Ambient Gamma (off-site areas) | 2 mrem/hr[(e)] | Implement immediate controls to reduce dose equivalent rate. |

Notes

(c) Potential Airborne Radioactivity Area as defined in 10 CFR 20. Workers with 1000 DAC-hours per year to date must wear modified Level C (full-face APR) until the end of the calendar year.

(d) The ambient gamma dose equivalent rate action level of 5 mrem/hr stems, from the 10 CFR 20 radiation area definition. If the ambient gamma dose equivalent rate reaches 2 mrem/hr, one or more of the following actions will be implemented: The source may be shielded; the working distance from the source may be increased; or the worker's exposure time may be limited.

(e) The ambient gamma action level for off-site is based upon the 10 CFR 20 requirements to maintain dose equivalent rates in unrestricted areas such that they do not exceed 0.002 rem in any one hour.

## 8.0 PERSONAL PROTECTIVE EQUIPMENT

It is anticipated that most excavation activities in designated exclusion zones can be conducted in Level D personal protective equipment (PPE), with a contingency upgrade to Level C, based on the action levels listed in Section 7. Level C will be used when required by Special Work Permits, or when directed by the Field Team Leader.

Level D personal protective clothing and equipment for excavation activities includes:

- Coveralls, disposable or washable through a contaminated clothing vendor. Coveralls are to be removed at the boundary of the exclusion zone.
- Hard hat
- Steel toed boots and chemically resistant booties (exclusion zone)
- Cotton or leather gloves (no soil contact); Nitrile gloves (Edmont 37-15 or equivalent) 0.40 mm thickness to be used if hand contact with soils is probable.
- Safety glasses
- Dust mask (optional)

Level C protective clothing and equipment includes:

- Full-face air-purifying respirator (NIOSH/MSHA approved) fitted with radionuclides/HEPA cartridges and/or organic vapor cartridges, depending on which action levels are exceeded (see Section 7 of this HASP)
- Coveralls
- Tyvek coveralls - required in areas when splashing by contaminated soils or water is a possibility
- Nitrile gloves (Edmond 37-15 or equivalent) 0.40 mm thickness
- Disposable latex inner gloves - required in areas when splashing by contaminated soils or water is a possibility
- Nitrile outer gloves (taped) - required in areas when splashing by contaminated soils or water is a possibility
- Steel toe boots with outer chemically resistant booties (taped)
- Hard hat

Action levels used to determine the need to upgrade or downgrade the levels of protection are described in Section 7 of this HASP.

## 9.0 CONTAMINATION REDUCTION PROCEDURES

### 9.1 Equipment

Portable equipment will be decontaminated with soap and water and rinsed with tap water. Heavy equipment will be steam-cleaned with water and, if necessary, a detergent solution.

### 9.2 Personnel

If levels of radioactivity show that individuals can remove coveralls and other personal protective clothing and equipment before leaving the exclusion zone and, thus complete decontamination, the individuals may leave the exclusion zone. If, however, levels of radioactivity show that individuals cannot achieve decontamination by the removal of coveralls and showering is required, they will be dressed in clean coveralls, boots and gloves and be transported to Northwestern Memorial Hospital to complete decontamination.

If substantial skin contamination occurs on an individual working with radioactive materials, the following specific procedures should be followed to prevent fixation of the material in the skin or absorption of the radioactivity through the skin.

> **Immediate Action**: Notify the HSC or Field Team Leader, who will supervise the decontamination. If contamination is spotty, the HSC or Field Team Leader will supervise the cleaning of the individual spots with swabs, soap, or water. If the contamination is general, the HSC or Field Team Leader may recommend washing the area gently in warm or cool water (not hot) using hand soap (not detergent) for one minute. Rinse, dry, and monitor for radioactivity. This soap wash step may be repeated three times.

**Evaluation**: If the above procedure fails to remove all the skin contamination, the treatment should cease. An evaluation of the skin contamination should be performed by the HSC or Field Team Leader including an estimate of the dose commitment to the skin, and the quantity and identity of the nuclides contaminating the skin If additional decontamination steps are necessary, they are performed and documented by the HSC. The guidelines for Personnel Decontamination in the Radiological Health Handbook, HEW 1970, beginning on page 194, can be used as applicable. **CAUTION**: Do not use chemicals for personnel decontamination until full evaluation of the contamination is made by the HSC or Field Team Leader.

## 9.3 Contamination Prevention

Work practices that minimize the spread of contamination will reduce worker exposure and help ensure valid sample results by precluding cross-contamination. Procedures for contamination avoidance include:

- knowing the limitations of all personal protective equipment being used

  avoiding walking through areas of obvious or known contamination
- refraining from handling or touching contaminated materials directly. Do not sit or lean on potentially contaminated surfaces
- ensuring personal protective equipment has no cuts or tears prior to donning
- fastening all closures on suits, covering with tape if necessary
- taking steps to protect against any skin injuries
- staying upwind of airborne contaminants

- When working in contaminated areas, refraining from eating, chewing gum, smoking, or engaging in any activity from which contaminated materials may be ingested

## 9.4 Disposal Procedures

All discarded materials, waste materials, or other field equipment and supplies should be handled in such a way as to preclude the spread of contamination, creating a sanitary hazard, or causing litter to be left on-site. All potentially contaminated waste materials (e.g., clothing, gloves) shall be monitored and segregated in accordance with monitoring results into either radioactive or non-radioactive waste. Appropriate labels shall be affixed to all containers of radioactive materials.

# 10.0 GENERAL WORK PRECAUTIONS

## 10.1 General Work Precautions

The following general work precautions apply to all Site personnel.

- Eating, drinking, chewing gum or tobacco, smoking, or any practice that increases the probability of hand-to-mouth transfer and ingestion of material is prohibited in the work area.
- Hands and face must be thoroughly washed upon leaving the work area. Wash water will be provided at the Site for this purpose.
- Whenever levels of radioactivity warrant, the entire body should be thoroughly washed, as soon as possible, after the protective coveralls and other clothing are removed as part of the decontamination process.
- No facial hair that interferes with a satisfactory fit of the mask-to-face-seal is allowed on personnel required to wear respirators.
- Contact with contaminated or suspected contaminated surfaces should be avoided. Whenever possible, do not walk through puddles, leachate, discolored surfaces, kneel on ground, lean, sit, or place equipment on drums, containers, or the ground.
- Medicine, drugs and alcohol may interfere with or impair judgment and reaction times. Therefore, usage of prescribed drugs must be specifically approved by a qualified physician and made known to the Field Team Leader prior to an individuals' presence on the work-site. Alcoholic beverage intake is strictly prohibited at the Site and prior to work.
- All personnel must be familiar with standard operating procedures and any additional instructions and information contained in the HASP.
- All personnel must adhere to the requirements of the HASP.
- Contact lenses are not permitted when respiratory protection is required or where the possibility of a splash exists.

- Personnel must be cognizant of symptoms for radiological exposure onsite, for heat stress and cold stress, and knowledgeable regarding emergency measures contained in the Emergency Contingency Plan.

- Respirators shall be cleaned and disinfected after each day's use or more often, if necessary.

- Prior to donning, respirators shall be inspected for worn or deteriorated parts. Emergency respirators or self-contained devices will be inspected at least once a month and after each use.

- Each employee shall be familiar with the project's Respiratory Protection Program.

## 10.2 Operational Precautions

The following operational precautions must be observed at all times.

- All Site personnel shall be adequately trained and thoroughly briefed on anticipated hazards, equipment to be worn, safety practices to be followed, emergency procedures, and communications.

- All required respiratory protective devices and clothing shall be worn by all personnel going into areas designated for wearing protective equipment.

- All Site personnel shall use the buddy system when wearing respiratory protective equipment. At a minimum, a third person, suitably equipped as a safety backup, is required during extremely hazardous entries.

- During continual operations, on-site workers act as a safety backup to each other. Off-site personnel provide emergency assistance.

- Personnel should practice any unfamiliar operations prior to undertaking the actual procedure.

- Entrance and exit locations shall be designated and emergency escape routes delineated. Warning signals for Site evacuation must be established.

- Personnel and equipment in the contaminated. work area should be minimized, consistent with effective Site operations.

- Work areas for various operational activities shall be established.

- Procedures for leaving a contaminated area shall be planned and implemented prior to going on-site. Work areas and decontamination procedures shall be established based on expected Site conditions.

- Frequent and regular inspection of Site operations will be conducted to ensure compliance with the HASP. If any changes in operation occur, the HASP will be modified to reflect those changes.

# 11.0 SANITARY FACILITIES

## 11.1 Potable Water

a. An adequate supply of potable drinking water shall be maintained at all times immediately outside the Site. Drinking water shall meet all federal, state and local health requirements.
b. Drinking water shall be supplied to project personnel via approved dispensing sources.
c. Paper cups shall be permitted for the drinking of potable water supplies.
d. Drinking water dispensers shall be clearly marked and shall, in no way, have the potential for contamination from non-potable supplies.
e. Site personnel must be fully decontaminated prior to approaching the drinking water supply.

## 11.2 Toilet Facilities

a. Adequate toilet facilities shall be provided at the Site.
b. These facilities shall be in the form of portable chemical toilets.
c. Routine servicing and cleaning of the toilets should be established with the selected contractor and shall be in accordance with federal, state, and local health regulations.
d. Site, personnel must be fully decontaminated prior to approaching the toilet facilities.

## 11.3 Washing Areas

a. Adequate washing areas shall be provided for personal use within the work area.
b. Washing areas shall be maintained in a sanitary condition and will be provided with adequate supplies of soap, towels for drying, and covered waste receptacles.
c. Washing areas shall be maintained and sanitized daily.
d. No eating, drinking or smoking shall be permitted in the work area. This policy will be strictly enforced by the Field Team Leader.

## 12.0 FIRE CONTROL EQUIPMENT

An adequate number of approved portable fire extinguishers (class rated A, B and C) shall be readily available at the Site at all times.

All Site personnel shall be trained in the use of the extinguishers. Extinguishers shall only be used on outbreak stage fires or fires of minor nature. The local fire department shall be contacted in the event of a larger fire and Site evacuation procedures should be commenced in accordance with the procedures described in the Emergency Contingency Plan.

# 13.0 CONFINED SPACE PROGRAM

## 13.1 Purpose

In the event that confined space work is a necessity, a Confined Space Program will be implemented. Training in the recognition of confined spaces is a component of the health and safety training program.

The purpose of the Confined Space Program is to establish procedures to protect personnel from this serious hazard in the course of their work; and at a minimum, to comply with 29 CFR OSHA 1910.146. This document assigns responsibilities and sets standards for personnel engaged in activities where confined spaces may be present.

## 13.2 Responsibilities

### 13.2.1 Health and Safety Coordinator

The Health and Safety Coordinator administers the Confined Space Program. The Health and Safety Coordinator's responsibilities include:

- Review of the HASP for potential confined space hazards and design alternative approaches to accomplish the confined space tasks;
- Coordinating and managing the Confined Space Program in the event one is required;
- Establishing priorities for implementation of the program;
- Assisting with recognition and implementation of the Confined Space Program;
- Advising project management on confined space issues; and

- Communicating the Confined Space Program to personnel by training related to specific Site activities.

13.2.2 Project Manager

The Project Manager directs the application of the Confined Space Program to project work. The Project Manager is responsible for:

- Working with the Health and Safety Coordinator to prepare information describing activities that might be conducted in a confined space area;
- Assuring that all personnel engaged in project activities are familiar with the definition of a confined space;
- Assuring that personnel .are familiar with .the Confined Space Program, and that project activities are conducted in compliance with the Confined Space Program;
- Assuming the responsibilities of the Field Team Leader if another person is not assigned these responsibilities.

13.2.3 Field Team Leader

The Field Team Leader is responsible for the implementation of the Confined Space Program on-site during field activities. The Field Team Leader is responsible for:

- Overseeing implementation of the Confined Space Program during field operations; and
- Reporting confined space work activity, and any violations of the Confined Space Program, to the Project Manager and the Health and Safety Coordinator.

#### 13.2.4 Personnel

Personnel are responsible for:

- Familiarizing themselves with the Confined Space Program and following it;
- Becoming familiar with the criteria for determining a confined space, and with the monitoring, permitting, and other requirements of the program; and
- Reporting immediately a confined space condition to the Field Team Leader.

## 13.3 Definition of a Confined Space

Confined space means a space that:

1. Is large enough and so configured that an employee can bodily enter and perform assigned work
2. Has limited or restricted means for entry or exit (such as pits, storage bins, hoppers, crawl spaces, and storm cellar areas)
3. Is not designed for continuous employee occupancy

Any workspace meeting all of these criteria is a confined space and the Confined Space Program must be followed.

## 13.4 Confined Space Entry Procedures

#### 13.4.1 Safety Work Permit Required

All spaces shall be considered permit-required confined spaces until the pre-entry procedures demonstrate otherwise. The Safe Work Permit for entry into a confined space must be completed before work begins; it verifies completion of the items necessary for

confined space entry. The Permit will be kept at the Site for the duration of the confined space work. If there is an interruption of work, or the alarm conditions change, a new Permit must be obtained before work begins.

A permit is not required when the space can be maintained for safe entry by 100% fresh air mechanical ventilation. This must be documented and approved by the Health and Safety Coordinator. Mechanical ventilation systems, where applicable, shall be set at 100% fresh air.

The Field Team Leader must certify that all hazards have been eliminated on the Entry Permit. If conditions change, a new permit is required.

13.4.2 Pre-entry Testing for Potential Hazards

a. Surveillance

Personnel first will survey the surrounding area to assure the absence of hazards such as contaminated water, soil, or sediment, barrels, tanks, or piping where vapors may drift into the confined space.

b. Testing

No personnel will enter a confined space if any one. of these conditions exists during pre-entry testing. Determinations will be made for the following conditions:

1. Presence of toxic gases or dusts: Equal to or more than 5 parts per million (ppm) on the organic vapor analyzer with an alarm, above background outside the confined space area; or other action levels for specific gases, vapors, or dusts as specified in the Health and Safety Plan and the Confined Space Permit based on knowledge of Site constituents;

2. Presence of explosive/flammable gases: Equal to or greater than 10% of the Lower Explosive Limit (LEL) as measured with a combustible gas indicator or similar instrument (with an alarm); and

3. Oxygen Deficiency: A concentration of oxygen in the atmosphere equal to or less than 19.5% by volume as measured with an oxygen meter.

Pre-entry test results will be recorded and kept at the Site for the duration of the job by the Field Team Leader. Affected personnel can review the test results.

c. Authorization

Only the Field Team Leader and the Health and Safety Coordinator can authorize any personnel to enter into a confined space. This is reflected on the Safe Work Permit for entry into a confined space. The Field Team Leader must assure that conditions in the confined space meet permit requirements before authorizing entry.,

d. Safe Work Permit

A Safe Work Permit for confined space entry must be filled out by the Health and Safety Coordinator or Field Team Leader. A copy of the Safe Work Permit is included as Figure 5.2.

e. Attendants

One worker will stand by outside the confined space ready to give assistance in the case of an emergency. Under no circumstances will the standby worker enter the confined space or leave the standby position. There shall be at least one other worker not in the confined space within sight or call of the standby worker.

f. Observation and Communication

Communications between standby worker and entrant(s) shall be maintained at all times. Methods of communication that may be specified in the Safe Work Permit and the HASP may include voice, voice by powered radio, tapping or rapping codes, signaling tugs on rope, and standby worker's observations that activity appears normal.

### 13.4.3 Rescue Procedures

Acceptable rescue procedures include entry by a team of rescuers only if the appropriate self-contained breathing apparatus (SCBA) is available; or use of public emergency services.

The standby worker must be trained in first aid, CPR, and respirator use. A first aid kit should be on hand and ready for emergency use. The standby worker must be trained in rescue procedures. Retrieval of an unconscious victim in a confined space will only be conducted by trained rescue personnel. An emergency call to 911 will be initiated to assist the victim.

## 13.5 Training

Personnel who will engage in field activities will be given annual training on the requirements and responsibilities in the Confined Space Program and on OSHA 1910.146. Only trained personnel can work in confined spaces. Workers should be experienced in the tasks to be performed, instructed in proper use of respirators, lifelines and other equipment, and practice emergency procedures and self-rescue.

Before each Site activity, the determination of confined space work will be part of the Site characterization process. Training in the site-specific confined space activities will be part of the site-specific health and safety training:

## 13.6 Safe Work Practices

- Warning signs should be posted. These include warnings for entry permits, respirator use, prohibition of hot work and emergency procedures and phone numbers.

- Cylinders containing oxygen, acetylene or other fuel such as gasoline must be removed a safe distance from the confined space work area.

- Purging and ventilating is done before work begins to remove hazardous vapors from the space. The space should be monitored to ensure that the gas used to purge the space (e.g. tank) has also been removed. Local exhaust should be used where general exhaust is not practical.

- The buddy system is used at all times. A standby person always must be posted within sight of, or in communication with, the person inside the confined space. The standby should not enter the confined space, but instead will call for help in an emergency and not leave the post. Communication should be maintained at all times with workers inside the confined space.

- Emergency planning in the HASP and a Safe Work Permit must be approved in advance and the proper rescue equipment must be immediately available.

## 14.0 ELECTRICAL LOCKOUT/TAGOUT

The Field Team Leader must approve all work in areas requiring lockout/tagout procedures. Specific procedures and permitting requirements will be specified in the HASP, or in a revised HASP based on the need for a worker to work around electrical equipment.

All systems must be locked out and tagged before the work begins. This includes pipes, air lines, electrical equipment and mechanical devices. The equipment must be start tested and approved for use by a worker by the Health and Safety Coordinator or the Field Team Leader by start-testing to make sure the locked-out equipment does not operate.

# The Infrastructure Imperative

**Attachment 5**

SOP-500 Immunoassay Pesticide Field Test Method

# Sample Extraction Kit User's Guide

STRATEGIC DIAGNOSTICS INC.

# Sample Extraction Kit User's Guide

## Intended Use

This extraction kit is for use with the appropriate immunoassay test kit. Each Sample Extraction kit contains the materials necessary to process twelve (12) soil or wipe samples.

## Test Principles

The reagents contained in the Sample Extraction kit have been optimized for fast, efficient removal of compounds from soil or surfaces and convenient preparation of the sample for immunoassay testing at levels of interest to the investigator. The system allows for reliable, convenient and cost effective determinations at the field testing or remediation site.

## Performance Characteristics

## Precautions

- Treat potentially contaminated samples as hazardous materials.
- Use gloves, proper protective clothing, and methods to contain and handle hazardous material where appropriate.
- Store all kit components at ambient temperature (18°C to 27°C or 64°F to 81°F).
- Do not mix reagents from kits of different lot numbers.
- When testing soil samples, samples obtained from areas adjacent to standing water, surface soils collected during or immediately after rain or snow, or any soils with relatively high amounts of water (≥ 30% by weight) should be dried prior to extraction. Contact technical service for recommended methods.
- Adequate sample number and distribution are the responsibility of the analyst.
- Do not dilute or adulterate test reagents; this may give inaccurate results.
- Cloudy or dark sample extracts may indicate the presence of interference in your sample. Please contact Technical Support if this occurs.

## Materials Provided

- Filter unit bottoms: 12 per kit
- Filter unit tops: 12 per kit
- Wooden spatulas: 12 per kit
- Plastic Weigh Boats: 12 per kit
- Bulb Pipettes: 12 per kit
- Ampule crackers: 12 per kit
- Extraction jars: 12 per kit
  (Jars for **soil** extraction contain 3 ball bearings)
- 10 cm x 10 cm Plastic Wipe Templates: 12 per kit
  (PCB Wipe Kit only)
- Gauze Wipes: 12 per kit
  (PCB Wipe Kit only)
- Protective gloves: 24 per kit
  (PCB Wipe Kit only)
- User's Guide
- Kit Specific Extraction Solution: 12 per kit as described below:

  20 mL of 100% Methanol for use with:

  Ensys PCB Soil/Wipe (Part # 7020301/7021301) *
  Ensys Petro Soil (Part # 7042301)
  Ensys PAH Soil (Part # 7061301) *
  Ensys Penta Soil (Part # 7000301) *
  RaPID Assay PCB (Part # A00133/A00134) *
  RaPID Assay PAH (Part # A00156/A00157) *
  RaPID Assay CaPAH (Part # A00200/A00201) *
  RaPID Assay TNT (Part # A00186) *

10 mL of 100% Methanol for use with:

Envirogard PAH in Soil (Part # 7060600) *
Envirogard BTEX in Soil (Part # 7004000)
Envirogard TPH in Soil (Part # 7042000)
Envirogard DDT in Soil (Part # 7310000) *
Envirogard PCB Soil/Wipe *
(Part # 7020800/7021600 or # 7021500/7021600)

20 mL of 90% Methanol for use in:

Envirogard Chlordane in Soil (Part # 7311000)
Envirogard Toxaphene in Soil (Part # 7420000)
Envirogard Lindane in Soil (Part # 7630000)

10 mL of 75% Methanol for use in:

Rapid Assay BTEX (Part # A00161/A00162)

20 mL of 75% Methanol with Sodium Hydroxide for use in:

Rapid Assay PCP (Part # A00110/A00111)

20 mL of 100% Methanol with Surfactant for use in:

Rapid Assay Cyclodienes (Part # A00216)

* **Indicates extraction solution is also available in bulk (i.e. two 125 mL bottles per kit)**

• Kit specific dilution material (for Ensys and RaPID Assay test kits)

- For Ensys test kits dilution ampules will be provided based on customer specified detection levels.
- For Rapid Assay test kits, 12 dilution vials with the appropriate volume of assay diluent (see "Dilute the Sample" section of this User's Guide) will be provided. The kit may also contain fixed volume disposable pipets and tips as appropriate.

## Materials Required and Ordered Separately

• 50 mL Combitips® for the Repeater pipettor - for 1.0 mL to 5.0 mL dispensing volumes (if using bulk extraction solution)

• Eppendorf Repeater pipettor (if using bulk extraction solution)

• Portable balance capable of weighing 10 g (for soil samples)

• Electronic timer

**NOTE:** Order replacement Combitips® separately. See the "Ordering Information" section.

## Materials Required but Not Provided

- Protective clothing (e.g., latex gloves)
- Liquid and solid waste containers
- Marking pen

## Soil Procedure

### Collect/Store the Sample

The following steps explain how to properly collect and store your samples.

1. Collect soil in appropriately sized and labeled containers.
2. Take care to remove excess twigs, organic matter, and rocks or pebbles from the soil sample to be tested.
3. Soils obtained from areas adjacent to standing water, surface soils collected during or immediately after rain or snow, or any soils with relatively high amounts of water ($\geq$ 30% by weight) should be dried before testing. Contact Technical Services for recommended methods.
4. When comparing data from fields and laboratory methods it is important that split samples are obtained from thoroughly homogenized samples.
5. Store soil samples at 4°C (39°F), staying within the EPA recommended holding times for your analyte of interest.

### Weigh the Sample

1. Verify digital balance is calibrated correctly by pressing the ON/MEMORY button on the instrument and placing the 100 g weight (in the pocket of the instrument cover) onto the balance. If the instrument does not read 100$\pm$0.1 g, you must recalibrate the instrument as per the manufacturer's instructions provided with your accessory kit.
2. Place an unused plastic weigh boat on the digital balance (provided in the Field Accessory Kit).
3. Press the ON/MEMORY button on the digital balance. The balance will beep and display 0.0.
4. Weigh out 10 $\pm$ 0.1 grams of sample into the weigh boat on the balance using a wooden spatula.

**NOTE: If the balance turns off prior to completing the weighing of the sample, use an empty weigh boat to re-tare the instrument and then continue.**

5. Repeat Steps 1-3 for each sample to be tested, using a new weigh boat and wooden spatula for each sample.

## Extract the Soil

1. Uncap an extraction jar (containing ball bearings) and place it on a flat surface. Label the extraction jar with the sample identification. Transfer 10 grams of sample from the weigh boat into the appropriately labeled extraction jar, using the same wooden spatula used to weigh the sample. Be careful to get your entire sample into the extraction jar.
2. Open the solvent ampule using the ampule cracker provided in your extraction kit by placing the ampule cracker over the scored neck of the ampule. The ampule cracker is designed to protect your hands from broken glass.
3. Pour the entire contents of one solvent ampule into the extraction jar and immediately recap the extraction jar. Do not leave the jar open or the solvent will evaporate and affect results.
4. Shake the jar vigorously for one full minute.
5. Allow the sample to settle for one minute or until a liquid solvent layer is observed above the sample.

**NOTE: If the solvent layer is not observed within 15 minutes, contact Technical Support for assistance. Clay samples are often difficult to extract because they absorb the solvent. In this case, Technical Support may recommend decreasing the soil to solvent ratio. This will affect detection levels and should be discussed in advance**

6. Repeat Steps 1-5 for each sample to be tested.

## Filter the Extract

1. Insert the bulb pipet into the top (liquid) layer in the extraction jar (being careful not to disturb the lower, solid layer) and draw up some of the sample. Transfer at least ½ bulb capacity into the bottom portion of the filtration unit. **Do not use more than one full bulb.**
2. Press the top portion of the filtration unit (which is the piece with the cap and filter) into the bottom portion (containing the sample) until it snaps together or until the majority of the liquid has passed upward through the filter. Place on a flat surface.
3. Repeat Steps 1-2 for each sample to be tested.

**NOTE: Do not store sample in the filtration unit for extended periods of time. The seal on the unit will not sufficiently prevent evaporative losses of the solvent. Evaporation of the solvent will affect results.**

## Dilute the Sample

***I. Envirogard and Ensys test kits*** – Use the filtered extract as "SAMPLE" in the test kit User's Guide procedure. The Ensys User's Guide describes a sample dilution method based on your individual testing needs.

***II. Rapid Assay*** – Dilute the filtered extract into the appropriate sample diluent as described in the following table:

| Kit | Extract Vol. (uL) | Diluent (mL) | *Total Dil. Factor | Test Range (ppm) |
|---|---|---|---|---|
| PCB | 25 | 25 | 2000 | 0.5 to 10 (Aroclor 1254) |
| PAH | 250 | 12.25 | 100 | 0.2 to 5 (Phenanthrene) |
| CaPAH | 200 | 9.8 | 100 | 0.01 to 0.5 (Benzo(a)pyrene) |
| BTEX/ TPH | 500 | 4.5 | 10 | 0.9 to 30 (total BTEX) |
| PCP | 50 | 25 | 1000 | 0.1 to 10 (PCP) |
| TNT | 50 | 25 | 1000 | 0.25 to 5 (TNT) |
| Cyclo-dienes | 250 | 12.25 | 100 | 0.1 to 2 (Dieldrin) |

***Note: "Total dilution factor" takes the extraction dilution into account as well as the kit dilution (i.e. 10 g soil to 20 mL solvent is a 2x dilution).**

a. Remove a pre-measured diluent vial from your extraction kit for each sample to be tested. Label vials with the appropriate sample identification. Vials contain the volume of diluent specified in the preceding table corresponding to your test kit.

b. Using the adjustable volume pipet (for volumes between 100 and 1000 uL) or the tan fixed volume pipet provided in the extraction kit (for 25 or 50 uL volumes) pipet the volume of filtered extract specified

in the table above directly *into* the liquid in the corresponding diluent vial.

c. Screw the cap tightly onto the diluent vial and mix by inverting several times. Repeat steps 1 and 2 for each sample being tested using a new, clean pipet tip for each one.

d. The diluted extract should be used as "Sample" in the test kit User's guide procedure.

## Wipe Procedure

### Collect/Store the Sample

The following steps explain how to properly collect and store your samples.

1. Collect sample in appropriately sized and labeled containers.
2. Wearing a clean pair of protective gloves provided in the extraction kit, uncap an extraction jar.
3. Open the solvent ampule using the ampule cracker provided in your extraction kit by placing the ampule cracker over the scored neck of the ampule. The ampule cracker is designed to protect your hands from broken glass.
4. Pour the entire contents of one solvent ampule into the extraction jar and immediately recap the extraction jar. Do not leave the jar open or the solvent will evaporate and affect results.
5. Soak a gauze pad in the extraction jar containing solvent. Remove the gauze wipe from the extraction jar carefully squeezing the excess solvent from the pad back into the extraction jar.
6. Hold a clean 10 x 10 plastic template on the surface to be wiped. Wipe the entire exposed area according to proper wipe sampling techniques. The wipe should be damp when finished.
7. Place the wipe back into the same extraction jar used in Step 4 and cap tightly.
8. Remove and discard the gloves.
9. Repeat Steps 1-7 for each sample to be tested.
10. Store samples at 4°C (39°F), staying within the EPA recommended holding times for your analyte of interest.

**Extract the Sample**

1. Shake the jar vigorously for one full minute.
2. Repeat for each sample to be tested.

### Filter the Extract

1. Insert the bulb pipet into the top (liquid) layer in the extraction jar and draw up some of the sample. Transfer at least ½ bulb capacity into the bottom portion of the filtration unit. **Do not use more than one full bulb.**
2. Press the top portion of the filtration unit (which is the piece with the cap and filter) into the bottom portion (containing the sample) until it snaps together. Place on a flat surface.
3. Repeat Steps 1-2 for each sample to be tested.

**NOTE: Do not store sample in the filtration unit for extended periods of time. The seal on the unit will not sufficiently prevent evaporative losses of the solvent. Evaporation of the solvent will affect results.**

### Dilute the Sample

***I. Envirogard and Ensys test kits*** – Use the filtered extract as "SAMPLE" in the test kit User's Guide procedure. The Ensys User's Guide describes a sample dilution method based on your individual testing needs.

***II. Rapid Assay*** – Dilute the filtered extract into the appropriate sample diluent as described below.

| Kit | Extract Vol. (uL) | Diluent (mL) | Total Dil. Factor * | Test Range (ppm) |
|---|---|---|---|---|
| PCB | 25 | 25 | 2000 | 5 to 100 ug/100 cm2 (Aroclor 1254) |

***Note: "Total dilution factor" takes the extraction dilution into account as well as the kit dilution (i.e. 10 g soil to 20 mL solvent is a 2x dilution).**

a. Remove a pre-measured diluent vial from your extraction kit for each sample to be tested. Label vials with the appropriate sample identification. Vials contain the volume of diluent specified in the table above corresponding to your test kit.

b. Using the adjustable volume pipet (for volumes between 100 and 1000 uL) or the tan fixed volume pipet provided in the extraction kit (for 25 or 50 uL

volumes) pipet the volume of filtered extract specified in the table above directly *into* the liquid in the corresponding diluent vial.

c. Screw the cap tightly onto the diluent vial and mix by inverting several times. Repeat steps 1 and 2 for each sample being tested using a new, clean pipet tip for each.

d. The diluted extract should be used as "Sample" in the test kit User's guide procedure.

## Limitations of the Procedure.

Sampling error may significantly affect testing reliability. The distribution of contaminants in soils can be extremely heterogeneous. Adequate sample number and distribution are the responsibility of the analyst.

## Ordering Information

| Description | Catalogue Number |
|---|---|
| SDI Sample Extraction Kit (with methanol in ampules or bulk) | Contact Customer Support |
| 50 mL Combitip for Repeating Pipette (1 each) | 6005600 |
| Portable balance** | A00131 |
| Eppendorf Repeater Pipettor** | A00008 |
| Electronic Timer** | A00015 |
| **** These items are also included in our field accessory kits which are available for rent or purchase.** | |

## Ordering/Technical Assistance

Should you have any questions regarding this procedure prior to analysis contact Technical Service to avoid costly mistakes.

To Place an Order or Receive Technical Assistance, please call Strategic Diagnostics Inc. at:

Call toll-free **800-544-8881**

Or 302-456-6789 Phone
302-456-6782 Fax
web site: www.sdix.com
e-mail: techservice@sdix.com

## General Limited Warranty

SDI's products are manufactured under strict quality control guidelines and are warranted to be free from defects in materials and workmanship. New instruments and related non-expendable items are warranted for one year from date of shipment against defective materials or workmanship under normal use and service.

Warranty obligation is limited to repair or replacement of the defective product or to refund of the purchase price, at the discretion of SDI. Other warranties, express or implied, are disclaimed. SDI's liability under any warranty claim shall not exceed the refund of the purchase price paid by the customer. Under no circumstances shall SDI be liable for special, indirect or consequential damages.

## Safety

To receive an MSDS for this product, visit our web site at www.sdix.com.

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EnviroGard™ Chlordane in Soil Test Kit

STRATEGIC DIAGNOSTICS INC.

# EnviroGard™ Chlordane in Soil Test Kit
## 7311000, EPA Method 4041

## Intended Use

The EnviroGard Chlordane in Soil Test Kit is a semi-quantitative enzyme immunoassay for the detection of Chlordane in soil. The Envirogard Chlordane in Soil Test Kit allows reliable and rapid screening for Chlordane at 20, 100 and 600 parts per billion (ppb) in soil. Samples can be screened with a 95% confidence of no false negatives at the specified action level.

## Test Principles

The EnviroGard Chlordane in Soil Test Kit is based on the use of polyclonal antibodies that bind either Chlordane or Chlordane-Enzyme Conjugate. These antibodies are immobilized on the walls of the test tubes. When Chlordane is present in the sample, it competes with the Chlordane-Enzyme Conjugate for a limited number of Chlordane binding sites on the immobilized antibodies.

- A sample containing Chlordane is added to a test tube containing Assay Diluent. Chlordane-Enzyme Conjugate is then added to the test tube. The Chlordane-Enzyme Conjugate competes with the Chlordane for the antibody binding sites.
- After the incubation, the unbound molecules are washed away.
- A clear solution of chromogenic Substrate is then added to the test tube. In the presence of bound Chlordane-Enzyme Conjugate, the clear Substrate is converted to a blue color. One enzyme molecule can convert many Substrate molecules.

Since every test tube has the same number of antibody binding sites and receives the same number of Chlordane-Enzyme Conjugate molecules, a sample that contains a low concentration of Chlordane allows the antibody to bind many Chlordane-Enzyme Conjugate molecules. Therefore, a low concentration of Chlordane produces a dark blue solution. Conversely, a high concentration of Chlordane allows fewer Chlordane-Enzyme Conjugate molecules to be bound by the antibodies, resulting in a lighter blue solution.

**NOTE:** Color development is inversely proportional to the Chlordane concentration.

Darker color = lower concentration
Lighter color = higher concentration

The determination of the Chlordane level in an unknown sample is interpreted relative to the assay calibrator levels using visual comparison or by reading with a spectrophotometer.

## Performance Characteristics

The EnviroGard Chlordane in Soil Test Kit will not differentiate between Chlordane and other structurally similar compounds, but will detect their presence to differing degrees. The following table shows a number of compounds and the approximate concentration of each required to yield a positive result at the low calibrator (Method Detection Limit or MDL). It also shows the concentration required to inhibit one-half of the color developed by the Negative Control (IC50). Concentration is in parts per billion (ppb) in soil.

| Compound | MDL | IC50 |
|---|---|---|
| Chlordane | 20 ppb | 100 ppb |
| Endrin | 4.4 ppb | 22 ppb |
| Endosulfan I | 7.2 ppb | 36 ppb |
| Endosulfan II | 5.6 ppb | 28 ppb |
| Dieldrin | 8.4 ppb | 42 ppb |
| Heptachlor | 6.8 ppb | 34 ppb |
| Aldrin | 23.2 ppb | 116 ppb |
| Toxaphene | 560 ppb | 2,800 ppb |
| Gamma-BHC * | 920 ppb | 4,600 ppb |
| Alpha- BHC | 3,800 ppb | 19,000 ppb |
| Delta-BHC | 8,000 ppb | 40,000 ppb |

*Gamma-BHC is Lindane

## Precautions

- Treat Chlordane, solutions that contain Chlordane, and potentially contaminated soil samples as hazardous materials.
- Use gloves, proper protective clothing, and methods to contain and handle hazardous material where appropriate.
- Store all test kit components at 4°C to 8°C (39°F to 46°F) when not in use. Storage at ambient temperature (18°C to 27°C or 64°F to 81°F) on the day of use is acceptable.
- Do not freeze test kit components or expose them to temperatures greater than 37°C (99°F).
- Allow all reagents to reach ambient temperature (18°C to 27°C or 64°F to 81°F) before beginning the test. This typically requires at least 1 hour to warm from recommended storage conditions.
- Do not use test kit components after the expiration date.
- Do not use reagents or test tubes from one test kit with reagents or test tubes from a different test kit.
- Use approved methodologies to confirm any positive results.
- Soils obtained from areas adjacent to standing water, surface soils collected during or immediately after rain or snow, or any soils with relatively high amounts of water (≥ 30% by weight) should be dried before testing. Contact technical service for recommended methods.
- Distribution of Chlordane in soils may be highly variable. This variability can be minimized through use of a composite sampling technique. Adequate sample number and distribution are the responsibility of the analyst.
- Portable spectrophotometer battery must be fully charged prior to use. It will not run directly off of AC current.
- Do not expose substrate to direct sunlight.
- Do not dilute or adulterate test reagents or use samples not called for in the test procedure; this may give inaccurate results.
- Tightly recap the Chlordane calibrator vials to prevent evaporative loss.

## Materials Provided

- 20 Antibody coated test tubes, 12 X 75 mm
- 1 vial of Assay Diluent
- 1 vial of Negative Control (Methanol)
- 1 vial of 20 ppb Chlordane Calibrator in methanol (actual concentration is 10 ppb)
- 1 vial of 100 ppb Chlordane Calibrator in methanol (actual concentration is 50 ppb)
- 1 vial of 600 ppb Chlordane Calibrator in methanol (actual concentration is 300 ppb)
- 1 vial of Chlordane-Enzyme Conjugate
- 1 vial of Substrate
- 1 vial of Stop Solution
- 1 20-Place test tube rack
- 22 Pink (50-250 µL) Gilson Microman® positive displacement pipette tips

NOTE: To determine the Chlordane concentration in soil, a dilution factor of 2 has been calculated in. This factor of 2 is derived from the extraction of the 10 grams of soil with 20 mL of solvent.

## Materials Required and Ordered Separately

See "Ordering Information" for the appropriate catalogue numbers.

### SDI Sample Extraction Kit

Use this kit for the extraction of Chlordane from soil samples. This kit contains enough devices to process 12 samples:

- 12 Extraction jars with screw caps, (each bottle contains 3 stainless steel mixing beads)
- 12 Filter modules (tops and bottoms)
- 12 Ampule crackers
- 12 Wooden spatulas
- 12 Weigh Canoes
- 12 Disposable Transfer Pipettes
- 12 Ampules containing 20 mL each of 90% Methanol

### Ensys/Envirogard Field Soil Lab (Accessory Kit)

Accessory equipment may be rented or purchased from Strategic Diagnostics. See "Ordering Information" for the appropriate catalogue numbers.

The accessory kit contains the following items:

- Gilson M-25 Microman Positive Displacement Pipettor
- Eppendorf™ Repeater® Pipettor
- Electronic timer

- Polystyrene test tubes, 12 x 75 mm (for blanking spectrophotometer)
- Portable balance capable of weighing 10 g
- Wash bottle
- 5.0 mL Combitips® for the Repeater pipettor -for 0.1 mL to 0.5 mL dispensing volumes (3)
- 12.5 mL Combitips® for the Repeater pipettor -for 0.25 mL to 1.250 mL dispensing volumes (6)
- 50.0 mL Combitip® for the Repeater pipettor (with adapter)-for 1.0 mL to 5.0 mL dispensing volumes (1)
- Thirty position foam racks (2)
- Artel differential photometer - allows you to measure results in the form of optical density values. These values can be used for objective record keeping and quality assurance. It is included in the Ensys/Envirogard Field Soil Lab.

**NOTE:** Order replacement Combitips® and positive displacement tips separately. See the "Ordering Information" section.

## Materials Required but Not Provided

- Protective clothing (e.g., latex gloves)
- Absorbent paper for blotting test tubes
- Liquid and solid waste containers
- Tap or distilled water for test tube washes
- Marking pen
- Calculator (optional)

## Suggestions for Pipettor Use

- Practice using both pipettors (positive displacement and Repeater pipettor) with water and extra tips before you analyze your samples.
- Use a new tip each time you use the Repeater pipettor to pipette a different reagent to avoid reagent cross-contamination. Label three 12.5 mL tips "Diluent", "Substrate" and "Stop," and one 5.0 mL tip "Conjugate". Tips can be rinsed thoroughly in clean water and reused. By using the same tip to dispense the same reagent each time, you can avoid reagent cross contamination.
- Draw the desired reagent volume into the Repeater pipettor and dispense one portion of the reagent back into the container to properly engage the ratchet mechanism. If you do not do this, the first volume delivered may be inaccurate.
- To add reagents using the Repeater pipettor, pipette down the side of the test tube just below the rim.
- When adding samples and calibrators using the positive displacement pipettor, always pipette below the liquid level. Pipet liquid up and down in tip to ensure complete volume transfer.
- The carryover volume of the positive displacement tips is minimal, but may affect results if you are going from a high to low Chlordane concentration. Use a new pipettor tip each time you pipette a new unknown.

## Assay Procedure

### Collect/Store the Sample

The following steps explain how to properly collect and store your samples.

1. Collect soil in appropriately-sized and labeled containers.
2. Take care to remove excess twigs, organic matter, and rocks or pebbles from the soil sample to be tested.
3. Soils obtained from areas adjacent to standing water, surface soils collected during or immediately after rain or snow, or any soils with relatively high amounts of water (≥ 30% by weight) should be dried before testing. Contact Technical Services for recommended methods.
4. Store soil samples at 4°C (39°F).

### Prepare the Sample/Extract the Soil

1. Please follow the instructions from the SDI Sample Extraction Kit to prepare the soil extract before the assay.
2. **20 mL of 90 % Methanol** will be used to extract Chlordane residues from **a 10 g** soil sample.

### Perform the Test

**NOTE:** Allow all test kit components to come to ambient temperature (at least 1 hour) before use.

1. Remove the Antibody coated test tubes from the foil pouch and label as follows (no more than 20 tubes/assay):

| Tube Label | Tube Contents |
|---|---|
| NC | Negative Control |
| C1 | 20 ppb Calibrator |
| C2 | 100 ppb Calibrator |
| C3 | 600 ppb Calibrator |
| S1 | Sample 1 |
| S2 | Sample 2 |
| Etc. | |

* To conserve reagents not all calibrators need to be run but you should always use the negative control and the relevant calibrators for your action level. You do not have to perform the assay in duplicate; however, doing so increases the accuracy of the test.

2. Place the test tubes in the test tube rack pressing down firmly on each tube so that they are secured.

**CAUTION:** Do not "snap" the test tubes into the rack as this may result in a cracked tube.

3. Position the Repeater pipettor at Setting 1 and use the 12.5 mL syringe to add 250 µL of Assay Diluent to all test tubes.

4. Attach a clean pink pipette tip to the positive displacement pipet and adjust the dial to "050" to pipet 50 µL.

5. Use the positive displacement pipettor to add the Negative Control (methanol), the Chlordane Calibrators, and the Sample extracts to the appropriate test tubes. **Use a clean pipette tip for each addition.**

**CAUTION:** Replace the cap(s) on the calibrator vials immediately after use to minimize evaporation.

6. Let tubes incubate for 15 **minutes.**

7. Attach the 5.0 mL Combitip labeled "Conjugate" to the Repeater pipettor and adjust the dial to 2 to add 200 µL of Chlordane-Enzyme Conjugate to each tube.

8. Gently shake the test tube rack to mix to 10 to 15 seconds. Leave the tubes undisturbed for 5 **minutes.**

9. Vigorously shake out the test tube contents into a sink or suitable container. Fill the test tubes to overflowing with cool tap or distilled water, then decant and vigorously shake out the remaining water.

   Repeat this wash step three more times, being certain to shake out as much water as possible on each wash. After the final wash, remove as much water as possible by tapping the inverted tubes on absorbent paper.

10. Position the Repeater pipettor at Setting 2 and use a clean 12.5 mL Combitip to add 500 µL of Substrate to all test tubes. Briefly shake the test tube rack to mix, then incubate for 3 **minutes.**

11. If a blue color does not develop in the negative control test tube within 3 minutes after you add the substrate solution, the test is invalid and you must repeat the entire test.

12. Position the Repeater pipettor at Setting 2 and use a 12.5 mL syringe to add 500 µL of Stop Solution to all test tubes. This will turn the color from blue to yellow.

**WARNING: Stop solution is 1.0 N Hydrochloric acid. Handle carefully.**

## Results Interpretation

You can either interpret the results visually within 3 minutes after adding the Substrate to each test tube, or you can perform a more precise analysis with a photometer after you add the Stop Solution.

### Visual Interpretation

After you add the Substrate, wait 3 minutes then mix the test tubes by shaking them for a few seconds. Compare the sample test tube to the calibrator test tubes against a white background. The test tube rack in the kit is well suited for this purpose.

- If a sample test tube contains *more* color than the calibrator test tube, the sample contains Chlordane at a concentration *lower* than the calibrator.
- If a sample test tube contains *less* color than the calibrator test tube, the sample may contain Chlordane at a concentration *greater* than the calibrator.
- If the sample test tube contains color that is between the calibrator test tubes, the sample contains Chlordane at a concentration between the calibrator concentrations.
- If a sample test tube contains *approximately the same* amount of color as the calibrator test tube, the sample contains Chlordane at a concentration *approximately equal* to the calibrator.
- If the sample test tube contains less color than the 600 ppb Calibrator test tube, you may dilute a fraction of the soil extract in 90 % methanol (for example, 1:10) and perform the assay again. To determine the concentration of the diluted extract multiply the result by the dilution factor. (Go to "Photometric Interpretation" for further details.)

### Photometric Interpretation

NOTE: After you add Stop Solution to the test tubes, results should be read within 30 minutes.

1. Dry the outside of all assay tubes prior to photometric analysis.
2. Place a blank test tube (from the EnSys/EnviroGard Field Accessory Kit) containing 1.5 mL of deionized water or equivalent in the left (reference) well of the differential photometer.

NOTE: Be careful not to mix plastic blanking tubes with the antibody tubes from the foil pouch in the test kit.

3. Place the Negative Control test tube into the right (sample) well. Record the optical density (OD) of the Negative Control.
4. Remove the Negative Control test tube and replace it with the 20 ppb Calibrator test tube to reactivate the photometer. Record the result. Repeat this step to determine the OD for each of the remaining calibrators and for each sample.

Compare the OD of each sample to the OD of each calibrator:

- If a sample OD is *equal* to the OD of a calibrator, the sample contains Chlordane at a concentration *approximately equal* to the calibrator.
- If a sample OD is *greater* than a calibrator OD, the sample contains *less* Chlordane than the calibrator.
- If a sample OD is *lower* than a calibrator OD, the sample may contain *more* Chlordane than that calibrator.
- If an assay result indicates that a soil sample contains greater than 600 ppb total Chlordane, but you need more specific information, the soil extract may be diluted 1:10 in 90% methanol, and assayed again. You must then multiply the results of the re-assay by 10 to determine the approximate sample extract concentration.

NOTE: If you know in advance that the "action level" of interest is greater than 600 ppb total Chlordane in soil, the assay may be modified to pinpoint that particular concentration.

## General Limited Warranty

SDI's products are manufactured under strict quality control guidelines and are warranted to be free from defects in materials and workmanship. New instruments and related non-expendable items are warranted for one year from date of shipment against defective materials or workmanship under normal use and service.
Warranty obligation is limited to repair or replacement of the defective product or to refund of the purchase price, at the discretion of SDI. Other warranties, express or implied, are disclaimed. SDI's liability under any warranty claim shall not exceed the refund of the purchase price paid by the customer. Under no circumstances shall SDI be liable for special, indirect or consequential damages.

## Safety

To receive complete safety information on this product, visit our web site at www.sdix.com.



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## Operation of the Repeater Pipet

### To Set or Adjust Volume

To determine the pipetting volume, the dial setting (1-5) is multiplied by the minimum pipetting volume of the tip (indicated on the side of the Combitip, e.g. 1_100 uL.)

### To Assemble Pipet Tip

Slide filling lever down until it stops. Then raise the locking clamp and insert the tip until it clicks into position. Be sure the tip plunger is fully inserted into the barrel before lowering the locking clamp to affix the tip in place.

### To Fill Tip

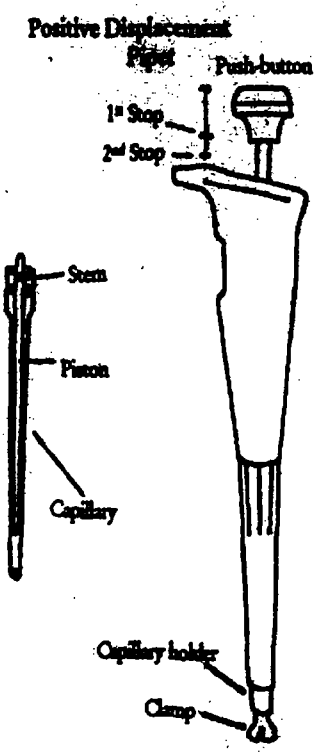
With tip mounted in position on pipet, immerse end of tip into solution. Slide filling lever upward slowly. Combitip will fill with liquid.

### To Dispense Sample

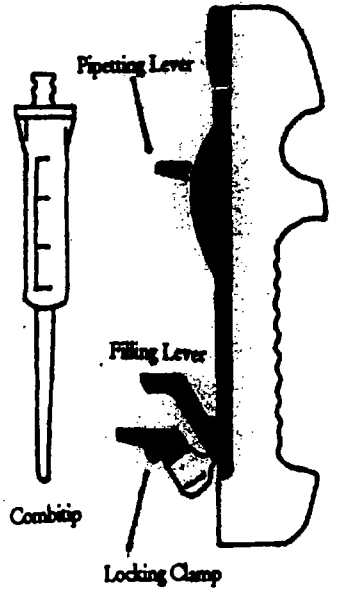
Check the volume selection dial to ensure pipetting volume. Place tip inside test tube so that tip touches the inner wall of tube. Completely depress the pipetting lever to deliver sample. NOTE: Dispense one portion of reagent back into the container to engage the ratchet mechanism and ensure accuracy.

### To Eject Tip

Empty tip of any remaining solution into appropriate container by pushing filling lever down. Raise locking clamp upward, and remove the Combitip.



Repeater Pipet




## Operation of the Positive Displacement Pipet

### To Set or Adjust Volume

Turn lower part of push-button to adjust volume up or down. See kit instructions for appropriate setting.

### To Assemble Pipet Tip

Press push button to 2nd stop to open clamp (see diagram, this is as far as push button will go down.) Select piston and slide stem fully into clamp. Slide mounted piston into capillary. Gently push capillary until it snaps onto capillary holder.

### To Withdraw Sample

With tip mounted in position on pipet, press push-button to 1st stop and hold it. (If you push beyond the 1st stop tip will eject.) Place tip at bottom of liquid sample and slowly release push-button to withdraw measured sample. Ensure that no air bubbles exist in the pipette tip. If bubbles exist, dispense sample and re-withdraw.

### To Dispense Sample

Wipe any liquid from outside of capillary taking care not to touch orifice. Place tip into dispensing vessel (immersing end of the tip if vessel contains liquid) and slowly press push-button to 1st stop. Pipet liquid up and down in tip to ensure complete transfer. Hold push-button at 1st stop when removing tip from vessel.

### To Eject Tip

Press push-button to second stop. Tip (capillary and piston) is ejected.

**NOTE: When using yellow tips on the positive displacement pipet, pipetting volumes range from 5-25 uL. (i.e. Pipet set on 2-5-0 will pipet 25 uL.)**
**When using pink tips on the positive displacement pipet, pipetting volumes range from 50-250 uL. (i.e. Pipet set on 2-5-0 will pipet 250 uL.)**